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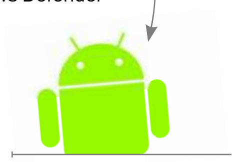
inside
MAY 2013



On the Cover
Illustration by
Georg Zumbulev



QUICKSTART


Android OS

R&D

LETTERS

IN THE LAB







MORE +

MAXIMUM PC

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Gordon Mah Ung

WELCOME TO THE PC PARTY! (OR, HOW THE PC WINS. AGAIN.)

AS THE 2013 chairman of the PC-platform welcoming committee, I would like to officially welcome the PlayStation 4 to the party. Punch and pie will be served after the meeting. Sure, we've had our disagreements in the past (one day you'll learn how to use a mouse and keyboard), but I'm certain you're going to love the PC platform.

There's plenty of company, too, as even your frenemy, the Xbox 720 (not its real name), appears headed to our gathering! There will be more punch and pie when it arrives—or rather, *comes back*, as the original Xbox was a PC until it decided to explore its processorality. Let's just say Power PC left a bright red ring on its face.

Since you're both now in the club, we can all agree that the PC platform is superior, without the usual grumbling and kvetching we hear from the peanut gallery, right? I know, those habits die hard, as we're still misinformed by headlines such as *Forbes*'s claiming, "Why Sony's Next Console Is Truly Next-Gen and Your PC Isn't." Hipster nerd, please. Can't we just agree, as Sony does, that the PS/4 uses PC parts (albeit "supercharged")? In most people's book, that still makes it a PC. Just as the Macintosh has actually had people fooled for years because it is, essentially, a PC.

Since the PS/4, Xbox 720 (or whatever it will be called), and the Macintosh are officially part of the PC platform, the matter seems to be settled: The PC is the superior architecture.

Now we just have to get to work spreading the word of the PC platform's greatness to the remaining skeptics. These are fertile grounds, too, including the vast majority of tablet and smartphone partisans, who simply don't believe the PC can win on those fronts, too. Because, well, you know, performance doesn't matter in phones and tablets, so that old PC model of performance improvement and upgrade cycles is irrelevant. Umm, yeah.

Let's not get sidetracked, though, because today is a day to celebrate new members to the platform. So, welcome aboard, PlayStation and Xbox, we're happy to have you here.



Gordon Mah Ung is Maximum PC's deputy editor, senior hardware expert, and all-around muckraker.

submit your questions to: comments@maximumpc.com

THE NEWS

The Light is Green for Windows Blue

Microsoft's hybrid Service Pack/Feature Pack for Windows 8 begins to take shape

YOU DON'T HAVE to be Sherlock Holmes to detect that Microsoft's flagship operating system has some kinks to work out. In its defense, Windows XP was arguably in worse shape when it debuted in October 2001. And Vista had just a few issues to work out, as well. What's unexpected is the extent of this new update, dubbed Windows Blue (which will apparently get a public preview in mid-summer before a full release in August). What's more, it's reported to be the beginning of an annual update process, similar to OS X's—but without a price tag. It took nearly two years for Microsoft to release Windows 7's Service Pack 1, and it was mostly bug fixes. But while Microsoft won't officially confirm the contents of Windows Blue or discuss its long-term strategy with it, its existence is practically a forgone conclusion. Let's draw a sketch of where MS is reportedly going with Blue.

POWER PLAY

Windows 8 is actually a pretty snappy operating system. It boots quickly, programs open and close without unusual delay, and it's a generally stable experience. However, battery life could be better, particularly for the Intel-based Surface tablet. In the three and a half years since Windows 7 came out, mobile computing has driven a deep wedge into the front line of desktop computing. Apple came out with a popular tablet, and Samsung et al followed suit with Android-based competitors. Microsoft and its traditional x86 partners weren't able to adapt quickly enough (though Haswell may change things). Windows Blue will apparently tweak Windows 8's energy consumption to compete with platforms that didn't exist a few years ago.

FINDERS KEEPERS

Another issue is the Modern UI's Search function, which has a habit of not finding things that it should. The search function in Start button replacements like Classic Shell seem to work as well as before, so the problem probably doesn't run too deep. Windows 8's Search mainly has problems detecting data that's linked to Modern apps (which are kind of a big deal). We expect MS to fix this issue, plus improve integration with Bing Search (which is actually a pretty good service for hunting down particular images and video clips). You'll probably get a shortlist of recommended programs when you search for media.

BUT WAIT, THERE'S MORE

The new features don't stop there. We're told that MS will also bundle Internet Explorer 11. But other than its version number, we know nothing about it. It would be nice to see an extensions/add-ons library, though. Windows Live Mail, MS's free desktop email client, is expected to get an update. The other programs in MS's downloadable "Windows Essentials" package, like Messenger, Writer, and Movie Maker, will probably also get some polish.

ALL IN THE FAMILY

If the rumors are to be believed, this plan doesn't end with Windows 8. We've heard that MS intends to extend this annual update initiative to Windows Server 2012, Microsoft Office, Outlook.com, and possibly other large projects. Corporate IT tends to want a less-frequent release cycle because that makes things easier to maintain and troubleshoot. So, it's unclear how a relatively fast schedule will play out in the business sector, whose support contracts and bulk licensing earn MS billions of dollars per year. **–Tom McNamara**

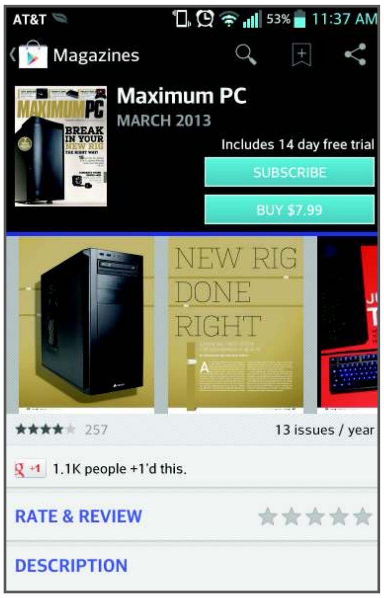


Windows Blue will apparently bundle Internet Explorer 11 and improve desktop Search, as well as increase performance and fix bugs.

Android Apps on Windows 8

You may have heard about Bluestacks, a program that allows you to run Android apps on x86 Windows PCs. Its developer announced in February that it added support for Windows 8. This boosts the Windows 8 apps population from less than 50,000 to over 800,000. And the upcoming Windows Blue is reportedly overhauling Windows 8 Search to integrate apps.

It is not yet clear what advantage you will gain from running mobile apps on your desktop, since the bulk of them are just miniaturized versions of desktop programs, but it probably increases Google and Android's visibility. If Bluestacks can recognize your webcam as a phone camera, that's like a billion more people who can send you photos with Instagram filters. **–TM**



Dell Buyout Meets Resistance

Since we mess with computers for a living, the *Maximum PC* staff generally gets its financial acumen from 1990s buddy comedies like *Taking Care of Business.* Connoisseurs of film will of course recall Charles Grodin's prescient nugget: You never accept the first offer. In February, life imitated art as a number of groups holding large amounts of Dell stock decided that the buyout valuation of $13.65 per share was surely in jest.

The *New York Times* reported that Southeastern Asset Management, which owns 8.5 percent of Dell, would like a price closer to $24. Investment firm T. Rowe Price, which is not known for courting drama, has 4.4 percent of Dell's shares and publicly criticized Michael Dell's current offer, according to Reuters. **–JK**



HP Shifts Focus to Tablets

At the Morgan Stanley Technology, Media & Telecom Conference (say that three times fast) in February, Hewlett-Packard CEO Meg Whitman stated that HP would be shifting resources from PCs to tablets. She did not go into much detail, unfortunately, so we don't know the degree to which this will affect the company's PC manufacturing or long-term pipeline—which is kind of a big deal, since HP is currently the biggest PC maker in the world. But Whitman asserted that the market had shifted from the desktop to the mobile space. This announcement came on the heels of HP releasing its first Android tablet, the $169 Slate 7, which can be found in a mouth-watering Creamsicle orange (ice cream center not included). **–TM**



Tom Halfhill
Fast Forward

COUNTING CORES

POP QUIZ: How many cores does a quad-core processor have? If you answered "four," you flunk.

Sorry, that's not fair. Usually a quad-core processor does indeed have four cores. But these days, it may have five or even eight cores. Depends how we count them.

Things are getting confusing because chip designers are trying new tricks to save power. For example, Nvidia's Tegra 4 is the first quad-core smartphone processor to integrate four of ARM's Cortex-A15 cores on one chip. But actually, it has *five* of those cores. Four are optimized for high performance and do the heavy lifting when the software workload is demanding; they scream at 1.9GHz. The fifth core is optimized for low power and runs alone when the workload is light; it hums at 700–800MHz.

So, is the Tegra-4 a quad-core processor or a five-core processor? At my day job at *Microprocessor Report,* my boss and I debated this question. He says it's a quad-core because only four cores can run at once. "Yeah," I said, "but it still has *five*!"

The confusion will only get worse. Samsung recently introduced the Exynos-5 Octa, a smartphone processor with eight CPU cores. Four of them are Cortex-A15s and four are Cortex-A7s, in paired configurations that ARM calls "Big.Little" (see my February 2012 column). Under heavy workloads, the bigger A15 cores shoulder the burden. Under light workloads, the A15s slumber to save power, and the littler A7s take over. It's an eight-core processor, but I can see the logic in calling it a quad-core if only four are awake at once.

Although these examples are smartphone processors, PC processors will soon play similar tricks. For power efficiency, it's great. But beware of the marketing hype—you may not get all the cores you're counting on.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report.*



Thomas McDonald
Game Theory

EMBRACING THE ARCADE

ONE THING I miss by not frequenting idiot magnets like Reddit is the latest outrage tearing its way through the game community. EA is the once and future object of all hatred, and the latest villainy is their desire to make money and give a return on its stocks.

I know! It's like they just take time off from rolling hobos to run a profit-oriented, publicly traded entertainment company that produces a wholly optional luxury product for the developed world!

The latest WMD supposedly descending on gaming is the microtransaction or IAP (in-app purchase), which has already defined mobile gaming. There are memes and breathless commentary about how this is the beginning of the end. PC gaming website Rock, Paper, Shotgun titled an otherwise reasonable piece "In The Grim Darkness of EA's Future, There Are Only IAPs" and paired it with an image of Scrooge McDuck frolicking in his money vault.

The current stink is about Dead Space 3 (see review, page 88), in which you can buy resources as well as gather them. Higher-level weapons are still locked at the beginning, so you can't trivialize combat by pouring cash into overpowered weapons right away. But, if it's worth a few bucks for you to push through the game at a faster pace, then it's a good option.

Hey, there's that word! *Option*. The game plays perfectly well without IAPs, just like others play fine without horse armor. But even if the whole future of gaming is in microtransactions, what of it? Giving away the base game and charging for faster unlocks is working fine in Tribes: Ascend and Smite, and video arcades have had microtransacted for decades. As long as the IAP merely enhances the experience without becoming mandatory, I don't get the problem.

As with anything in a free-market economy, consumers will decide if this model succeeds. If they pay, it works. If they don't, it fails. It's that simple.

You can follow Thomas McDonald on Twitter: @StateOfPlayBlog.

MS Office: License Renewed

In February, Aussie newspaper *The Age* reported that retail copies of Office 2013 would be tied to a single PC, like an OEM license. The End User License Agreement in this version was altered to say that you could not transfer this copy of Office to another computer, unless your current PC failed under warranty.

By March 6, however, Microsoft reversed its position, changing the licensing language to that of Office 2010. This was "based on customer feedback," according to Jevon Fark, senior marketing manager for Microsoft's Office division, who made the announcement on the official Office blog.

The change is effective immediately and applies to all retail Office 2013 suites, and each Office 2013 application when sold separately. **–TM**



AMD Cures Bad Hair

Bothered by "totally unrealistic hair" in video games? According to AMD, we've all been duped in the 3D era by short haircuts, up-dos, and even non-removable helmets, all of which are attempts to disguise the problem. Oh, the outrage! But fear not, fellow gamers—AMD's TressFX Hair technology signals an end to those hideous hair days.

How do they do it? DirectCompute performs real-time physics simulations, *obviously*. TressFX is already featured on Lara Croft in the 2013 release of Tomb Raider. Unfortunately, DirectCompute is Windows-only. But this should not be impossible to do in OpenCL, which has native Linux support. **–PL**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

AMD
Beleaguered firm scores with Sony PS4 GPU contract.

NVIDIA
GTX Titan puts single-GPU crown solidly in its camp.

BEST BUY CUSTOMERS
Online price-matching lets us buy locally using online prices.

MAXIMUM PC NO BS PODCAST
After years of spotty delivery, we published two podcasts in one month.

TRAGEDIES

GOOGLE
Chrome loses market share... to Internet Explorer. The horror.

MICROSOFT AND FACEBOOK
Both companies were hacked by visiting an iOS dev site.

OCZ
The cash-strapped company ponders selling its PSU division.

THE PC MARKET
Analysts forecast a second consecutive year of shrinkage in 2013.



Quinn Norton
Byte Rights

UNLOCKING THE LAW

AN INTERPRETATION of the DMCA (Digital Millennium Copyright Act) that became fashionable a while ago made it against the law to unlock your own cellphone and take it to any carrier. This should have indicated to Congress that the DMCA is a ridiculous and overly broad law. Instead, the Librarian of Congress just made a temporary exception for unlocking. Then this year, that exception expired, and the Librarian let it lapse.

At this point, unlocking your phone could get you five years in federal prison, according to the letter of the law. "WHAT?!" I hear you say. Well, most intellectual property provisions are civil, but they become criminal when done for financial gain. So, making your legal purchases work better is turning into a financial crime. When half the value of your phone is lost when a law says that you can't flip a software bit, something has gone horribly wrong with how we value phones. And software.

Fortunately, the White House saw how shocking this was when over 100,000 people signed a petition on its website to restore unlocking. It agreed that this function was necessary, even if that endangered loss-leader cellphone business models. But this is missing the point. Things like the DMCA and CFAA (which can criminalize breaking a click-through end-user license agreement) are a framework of laws that criminalize improving the things that you own and interact with. Usage restrictions are so ubiquitous now that we define "being able to use your stuff the way you want to" as a premium service. People often think that these laws wouldn't actually be enforced, but law enforcement has increasingly shown that it doesn't really have a medium setting. When you're in their sights, they use everything they can get. Vague, bad laws, and aggressive enforcement? That's a bad combo, society.

Quinn Norton writes about copyright for Wired News and other publications.

Let Your Finger Do the Mousing

Wired magazine reported in February on an interesting-looking wireless mouse called the Mycestro. It uses 3D gesture controls to navigate your desktop interface. Oh, you also slip it on your finger and wear it like a piece of futuristic jewelry. Lobbying for a relatively modest $100,000 of development funding on Kickstarter, project leader Nick Mastandrea found his target met within a matter of days.

Like many inventors, he was inspired by observing someone struggling with a common problem. In this case, it involved the ergonomics of flying coach. "I noticed a gentleman across the aisle," he says on the Kickstarter page. "His laptop barely fit on the seatback tray as he struggled to use a traditional mouse on the limited space of his laptop. Right then, the idea came to me—wouldn't it be cool if I could control my PC functions just by moving my finger? I immediately pulled out my project notebook and started drawing."

The device doesn't rely on webcam-style motion tracking. Instead, it uses a combination of accelerometers and gyros to communicate its location and movement to your computer. This fine-grained control should allow for much less strain and fatigue than the *Minority Report*–style input mechanisms that have been floating around.

The Kickstarter page says the device will use the Bluetooth 4.0 Low Energy Protocol and be rechargeable with a standard USB connector. Mastandrea estimates a battery life of eight hours and a range of up to 30 feet. He is targeting an October release date and a price of $80–$100. **–TM**



Google: No Retail Stores

Speculation brewed in February that Google was investigating potential real estate to build several retail stores, like Apple and Microsoft have done in recent years. It would presumably show off its Chromebook laptops, Nexus phones and tablets, and upcoming Motorola devices (Google bought Motorola's mobile division in August 2011).

However, at a reporter roundtable at the Mobile World Congress in Barcelona, senior VP and Android co-founder Andy Rubin quashed this rumor. According to tech website AllThingsD, he flatly stated, "Google has no plans and we have nothing to announce." However, Google did not give a clear answer at this event about alleged plans for a music streaming service akin to Pandora. **–TM**

Data Mining Revealed

UK newspaper *The Guardian* reported that Raytheon, a US defense contractor, had secretly developed a program in 2010 that can mine data from social networks to track your locations and even predict your behavior.

Since digital cameras frequently embed longitude and latitude into EXIF data, a library of photos uploaded to Facebook could basically produce a map of your movements over time. Raytheon's own Brian Urch makes this observation in a video obtained by *The Guardian*. The program can also use your public social network interaction to map your personal and professional associations.

Using publicly available information in this manner is legal in most countries. But Madagascar will probably shut down everything. **–TM**

THE LIST

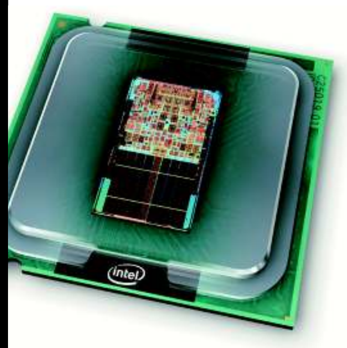
8 TECH HEROES

8 — 1999
AMD ATHLON

Despite a relatively small R&D budget, AMD produced the fastest desktop chip on the market and brought CPU prices down from orbit.



7 — 2006
INTEL CORE 2



...But Intel would eventually recover in a big way, producing powerhouses like the Q6600 that are still relevant six years later.

6 — 2009
WINDOWS 7

After Vista, Microsoft needed a hit, and a quicker turnaround. Win7 gave MS that elusive "it just works" aura.



5 — 2007
ANDROID OS



Without Google's efforts here, Apple would probably control the market (with a small slice for Windows Phone and Blackberry). Variety is the spice of life.

4 — 2001
THE IPOD



...But respect must be paid to the iPod, which refined the portable music player and eventually redefined it.

3 — 2004
MOZILLA FIREFOX

Like Android, Firefox arguably saved us from a de facto monopoly—Internet Explorer, in this case, which had become stale and quirky.



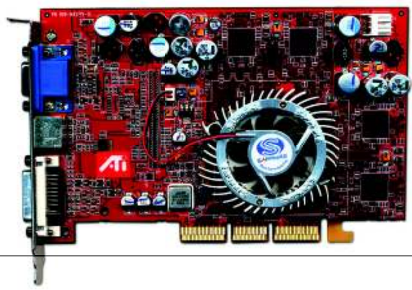
2 — 2004
GEFORCE 6800 ULTRA

Following the cacophonous GeForce FX 5800, Nvidia's 6 series fixed pretty much everything and gave ATI a run for its money.



1 — 2002
RADEON 9700 PRO

This shiny-coated polygon predator blew away the competition by every measure and brought antialiasing to an unprecedented level of quality.



HEAD TO HEAD

BY PAUL LILLY

Windows Defender vs. Avast

Windows 8 ships with a new version of Windows Defender that's supposed to offer the same level of protection as Microsoft Security Essentials. Along with other security upgrades, we're left wondering if there's any reason to saddle up with a third-party antivirus program. To find out, we compared Windows Defender with Avast, which as we discovered in last month's antivirus roundup is a formidable ally to have by your side as you romp around the web.



Avast is chock-full of settings and provides excellent real-time protection, no matter where the threats come from.

Round 1: Interface

There's a lot going on in Avast, so much, in fact, that you might not even notice that it doesn't scan for potentially unwanted programs (PUPs) by default, a setting we recommend enabling as an added ounce of protection (which, as you know, is worth a pound of cure). To get the most out of Avast, there's an initial time investment required to poke around all the settings and tweak everything just the way you want it. In stark contrast to Avast, Windows Defender takes a minimalist approach with an interface that's extremely straightforward and dead simple to navigate. There are just four headings to browse—Home, Update, History, and Settings—none of which tries to upsell you on security; Avast does. In this instance, simplicity gets the nod, and so does Windows Defender.

Winner: Windows Defender

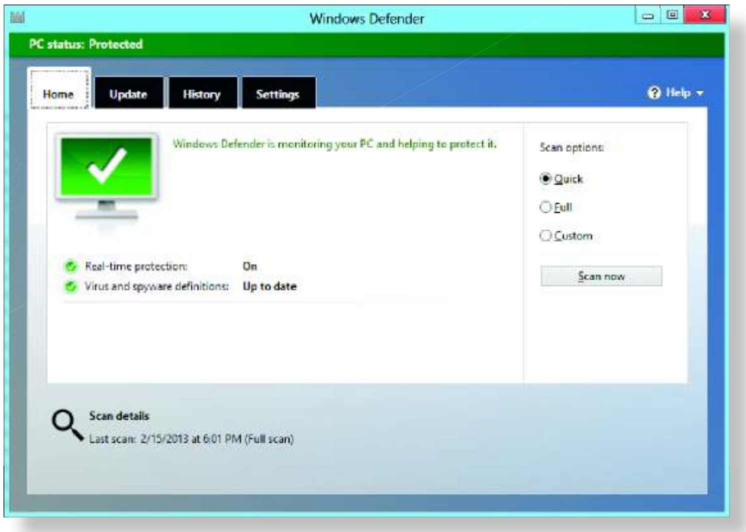
Round 2: Features

Whereas Windows Defender is super simple to navigate, it comes at the expense of an expansive feature-set. There's very little in the way of fine-grain control, limiting most of what you can do to including/excluding certain file types and locations, and whether or not you want to scan removable drives. You can't even schedule a scan, at least not through the traditional UI. To do that, you need to open up the Windows Task Scheduler and configure it through there. That's lame. Avast, on the other hand, offers a much bigger toolbox. The "AutoSandbox" feature alone, which automatically isolates suspicious programs from the OS, wins this category for Avast. There's also a remote assistance feature for troubleshooting family and friends who are running Avast, plus browser plugins, and more.

Winner: Avast

HEAD

Windows Defender doesn't integrate scheduled scanning into its UI. For that, you need to invoke the Windows Task Scheduler.



Round 3: Scan Speed

Windows Defender uses the same pokey scan engine as Microsoft Security Essentials, and since there's no easy way to schedule scans, it's even more problematic. Running a full system scan with 30GB of data on a solid-state drive took 20 minutes with Windows Defender, and subsequent scans took just as long. That's an indication that Windows Defender doesn't skip over files that haven't changed since the last time they were processed. Avast clocked five minutes and nine seconds to scan the same data, and though it also didn't get any quicker during subsequent scans, it's still significantly faster than Windows Defender. Plus, you can easily schedule scans in Avast to run during times when you're not sitting at your PC, such as after-work hours (assuming you leave your PC on 24/7).

Winner: Avast

Round 4: Performance Impact

Good news for both programs. If you're rocking a solid-state drive with Windows 8 on a relatively modern machine, you're unlikely to notice a performance impact with either Windows Defender or Avast installed. We slapped a 120GB Kingston SSDNow V300 drive onto an Asus P6X58D Premium motherboard with an Intel Core i7-930 processor, 4GB of DDR3/1333 RAM, and a Radeon HD 5850 graphics card. Boot times were virtually unaffected, with Avast introducing a startup penalty of just a few seconds. On the flip side, we recorded 4,035 in PCMark 7 with Avast installed versus 4,011 with Windows Defender. If this were a presidential race, it'd be too close to call. Subjectively, surfing the web and opening up programs felt equally snappy regardless of which AV program was running.

Winner: Tie

Round 5: Protection

Windows Defender needed to pull out a win in this round to keep the race interesting, but it doesn't have the legs to compete with Avast. Using our own collection of malware, Avast detected twice as many dirty files as Windows Defender, though that might have to do with the way each program counts individual files within an infected archive. In both cases, Malwarebytes detected infections that both Windows Defender and Avast missed. However, Avast is better at detecting zero-day threats and adds a second layer of protection through its automatic sandbox mode, which Windows Defender lacks. Finally, we're a little wary given that Microsoft's antimalware engine is having trouble passing certification with AV-Test (www.av-test.org), a well-known independent testing laboratory. All things considered, this crucial round goes to Avast.

Winner: Avast

And the Winner Is…

Avast wins this bout by taking three of the five categories and tying in another, though it's not quite as lopsided as it appears. Windows Defender, while not as fully featured as Avast, is capable of blocking common threats, and it doesn't put a drain on system resources. Avast's army of defenses is just bigger and better trained to spot danger from more places, like IM clients. It also has a bigger arsenal of weapons.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Wireless Uploads
> Case Upgrade
> Water-Cooling LAN Box?

Leaving the USB Cable Behind

I'd like a better way to transfer photos from my phone to my computer. Right now, I connect my device to the computer via USB and use the "drag-and-drop" method. I know I could also use AirDroid on my phone to transfer the files via Wi-Fi. The third option is to use Dropbox's instant upload feature to transfer the file (full size, highest quality) to my Dropbox account. It is then automatically downloaded to my PC via Dropbox.

The AirDroid and Dropbox methods are incredibly convenient and I find myself wanting to leave behind the hassle of connecting via USB. I am reluctant to change methods, though, because I don't want any data errors or quality erosion. Research I did a few years ago gave me the impression that data errors can happen when a file is sent wirelessly. Is there a reasonable risk of data loss using AirDroid or Dropbox, or has technology advanced enough that I can safely leave behind the USB cable?

—Rod

THE DOCTOR RESPONDS: Any transmission technique has potential for data errors, but that's why all data transmission techniques include error correction. From USB 3.0 to Wi-Fi to TCP/IP, the data correction algorithms are there to prevent errors from creeping into your data. The Doc has never had a digital file corrupted or distorted when transmitting it wirelessly.

You can test this yourself if you'd like. Take a picture from your phone and copy it to your computer via USB. Email a copy to yourself from your phone and upload another copy via Dropbox. They'll all end up exactly the same. You can test this by using a free tool to compare the files at the bit level.

The Doc took an image shot last week using a phone camera and emailed it. The file went from the phone through Verizon's network to the Internet to the work Exchange server, over the work LAN to the PC's RAM, then CPU, then hard drive. The same image, uploaded through Dropbox, went from the phone through Verizon's network to the Internet to Dropbox's servers to the work LAN and so forth to the PC. That's a long hop for any file and it's across a wireless carrier's data network, not just the Internet. Both WinMerge (free, www.winmerge.org) and the MD5 File Comparison tool (http://bit.ly/jKhpjR) agreed that the files were identical, bit for bit.

You should see absolutely no difference between the two files if everything is working correctly. If you are seeing differences between files, it's likely due to a hardware corruption issue, but such a problem would likely produce errors while you're running your OS, too. If it can't read or copy a simple image or Word file, it's probably going to also cough up a hairball opening a binary file. The Doc would not worry about data corruption, but if you're moving a lot of files, USB will almost always be faster. We say "almost" because certain cameras/phones transfer via USB at pretty atrocious speeds.

In general, though, unless you're transferring a lot of stuff at once, you're fine leaving the USB cable at home.

PCIe x8 SLI?

I recently built a video editing/gaming PC on the Asus P8Z77-V PRO motherboard. It's a great piece of hardware, but it only does SLI in dual x8 mode. When I install another GTX 670 next to my current one and connect the SLI bridge, am I going to see performance worthy of spending another $300? How does it compare to SLI in x16 mode?

—Alex Dalton

THE DOCTOR RESPONDS: You should see nearly double the performance of a single GTX 670 when you have two in SLI, regardless of whether they're in x16 or x8 mode. You won't see any slowdown even though you're in x8 mode; PCIe 3.0 x8 is more than enough to max out two 670s.

HDMI Out to DisplayPort In?

I've seen discussions about connecting a graphics card DisplayPort output to a video display's HDMI input port. Cables and adapters exist to make the physical connection. However, I'm wondering if the standards for the DisplayPort and HDMI ports allow for successful connection of a graphic card's HDMI output port to a video display's DisplayPort input. The physical connection is possible by all appearances, but will it function properly?

—Dennis Frill

THE DOCTOR RESPONDS: Nope. It's possible to go from a DP output to HDMI (or DVI, or VGA) but it doesn't work the other way. According to the DisplayPort FAQ (www.displayport.org/faq), there's "no cost effective way" of going from HDMI out to DP in. However, it's likely that HDMI isn't your GPU's only output, nor DisplayPort your monitor's only input. If the monitor has a DVI input, just use the DVI connector on your GPU. If your video card doesn't have

↘ submit your questions to: doctor@maximumpc.com

DVI out, and is truly HDMI-only, use an HDMI-to-DVI adapter cable—you can get one from Amazon for seven bucks. You'll miss out on audio over HDMI, but at least you'll have a picture.

Upgrading an Old Case

I have an old Lian Li PC-62 aluminum case that has been serving me very well for quite a number of years. I've upgraded the internal hardware a couple of times over the years, and will soon be upgrading again. The case is equipped with USB 2.0 ports on the front. If I upgrade to a new motherboard with USB 3.0 headers, I'd like to be able to get USB 3.0 from the front I/O ports. How different is the USB 3.0 connector from USB 2.0? Is it just a matter of connecting the port to the right header on the motherboard, or do I have to replace the entire port? Do they even sell replacement ports for the case, or do I have to go with an accessory to go into a spare 5.25- or 3.5-inch drive bay?

—Bob Berno

THE DOCTOR RESPONDS: The USB 3.0 internal header is very different from the USB 2.0 header, and is not compatible with the earlier ports. The USB 3.0 header has roughly twice as many pins. Lian Li's website has a page that lists the USB 3.0 upgrade kits for its models (www.lian-li.com/v2/cable/cable.html), but it doesn't look like the PC-62 is one of them.

The good news is that you can get a 3.5-inch drive bay adapter with two USB 3.0 ports and an internal header for $20. Silverstone makes one we like, and it comes in both black (FP36B) and silver (FP36S), so you should be able to get one that matches your case.

Too Many PCIe Flavors

With the arrival of Windows 8, I upgraded my HP Pavilion Elite f9550—originally a Vista machine, later upgraded to Windows 7—ASAP. It has its original ATI graphics card for the PCIe 2.0 slot. AMD has dropped the card into legacy support, and while the driver seems to work in Win8, it gives an odd dialog box on shutdown. So I'm wondering if I can get a new card with support. Can I put a PCIe 3.0 card in my PCIe 2.0 slot, running at a slower bus speed? And what are my options for upgrading? I'd love to have a card that allows programming for more than graphics output.

—William Biesty

THE DOCTOR RESPONDS: Yes, you can put a PCIe 3.0 card into a PCIe 2.0 slot and it will run at PCIe 2.0 speeds. When PCIe 2.0 bandwidth truly starts being a limiting factor in graphics cards (it really isn't yet), you will have to upgrade to a newer motherboard, one with a chipset or CPU that supports PCIe 3.0 or later. But by then, you'll certainly have gotten your money's worth from your current machine.

Dude, Where's My Boot Drive?

I installed a Corsair Neutron SSD on my PC and copied my system partition from a Western Digital hard drive to the SSD using Acronis's disk clone feature. The SSD is bootable via F8 key during startup. However, when I attempted to alter the boot priority in the BIOS, the BIOS editor lists only the old WD hard drive among the options for boot priority. My motherboard is an Asus P6T. I would like to know how to get the BIOS to recognize all of my bootable drives and allow me to boot from the SSD without hitting F8 every time.

—Wayne Godsey

THE DOCTOR RESPONDS: There are two separate fields in the BIOS that impact boot priority. The first one is the one that determines whether you'll boot from USB, CD, or HDD, and the second one, called "HDD Boot Priority," or "Hard Drive BBS priority" determines which

hard drive will show up in the boot priority list. Make sure the SSD is the top priority in the "Hard Drive BBS Priority" field and you should boot into it automatically from now on.

Bang My Bucks

Doc, I'm currently running an AMD Athlon 64 X2 6000+ in an Asus M3N-HD/HDMI mobo. I have 8GB of DDR2/800 RAM, a GeForce GTX 560 Ti, and a 1TB WD Caviar Green hard drive. I use my PC primarily for gaming. I'm not worried about upgrading the hard drive since I still have a lot of space left, and while I understand that an SSD would speed up start and program loading, it's not something I care enough about to spend money on at the moment. My video card seems to be good enough for now, also. I am thinking about upgrading my CPU/mobo/RAM, though. I'm hoping to spend around $750. I think by checking different sites for deals I would be able to grab the CPU/mobo/RAM you have in your magazine on the Performance build list (Blueprint). Would that be the best bang for my buck, or should I look for something different?

— Jess Harrington

THE DOCTOR RESPONDS: For a performance-oriented upgrade on a gaming box, our budget pick is the Core i5-3570K part. It's a quad-core without Hyper-Threading and overclocks nicely for the money. The issue with that CPU and the entire LGA1155 platform is that it is at the end of the line. With Intel's fourth-generation Core i7 chip (code-named Haswell) and its LGA1150 socket just around the corner, buying into LGA1155 doesn't give you many upgrade options. That said, unless you're the kind of user who likes to drop in new CPUs every 12 months, you'll be fine with that CPU for a long time—and like we said, the midrange 3570K part is a great gaming CPU.

If you are the type that likes to upgrade your CPU regularly, you should consider building on the LGA2011 platform with a Core i7-3820 chip. It's a bit pricier when you're done, but the upgrade path is better in the long run.

There is one more route, as well. If you game primarily at 1080p resolution and your games are not CPU-intensive (and most aren't), you could do an incremental CPU upgrade by going to a Phenom II X4 965. They go for a mere $85, overclock nicely, and give you upgraded cores, as well as two more of them. Asus's website indicates that your motherboard supports Phenom IIs up to X6 parts with the latest BIOS. With your remaining $650, you can invest in an SSD (an absolute must-have on a modern PC) and a faster GPU (and maybe a new PSU to support them). The Doc would normally recommend a second 560 Ti in SLI, but it's not clear if that board actually supports anything beyond Hybrid SLI. The nForce 750a chipset your board uses does support SLI, but we're unsure about the board itself. Your manual should be able to tell you. If it does support SLI, a second 560 Ti would likely help frame rates more than moving to Ivy Bridge would. If the board does not support SLI, sell your 560 Ti SLI and replace it with a GeForce GTX 670, which is a serious step up over the 560 Ti SLI. In the meantime, you'll have enough CPU to hold you over until Intel's Haswell arrives sometime this summer.

Keep in mind, the Doctor is recommending the last route only if you are primarily a gamer and the games you play are not known to be CPU-bound. If you do any CPU-intensive tasks such as photo or video work, a move to the 3570K or 3820 would be a gigantic leap forward in performance for you.

Water-Cooling LAN Box?

I'm looking to get into water cooling, but I regularly attend private LANs. I can't find a decent water-cooling case that has a handle. I prefer the handle because of an old injury. Is there a good case you could suggest? My computer is regularly moved but I still prefer it over the laptop, for the performance over the convenience.

Form factor isn't an issue—I have a mid-tower but a full-tower isn't out of the running. I just want something that has decent room for water and for a Sandy Bridge/SLI setup.

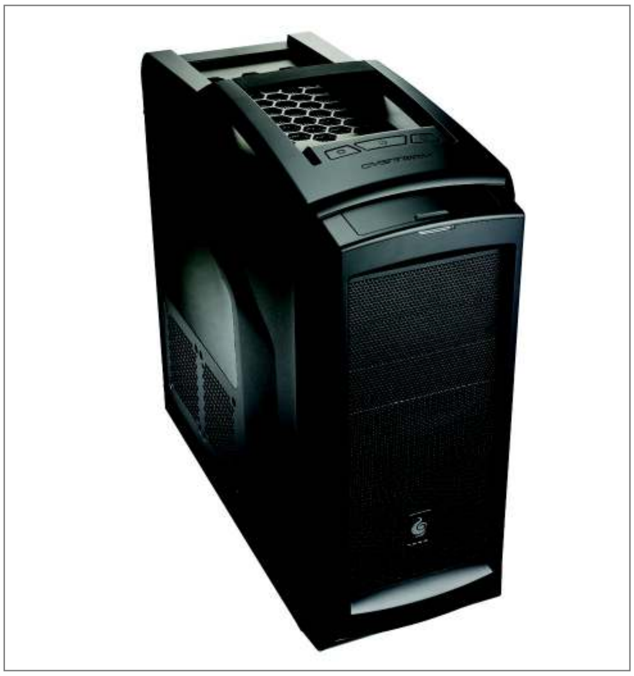
—Joey Chatterton

THE DOCTOR RESPONDS: Water-cooling and LAN cases normally don't go together, Joey, because a custom water-cooling setup can easily add 20 pounds to your rig. If you move your rig around frequently, you're better off with air-cooling or a sealed liquid-cooling unit—you're less likely to damage your system by subjecting a water-cooling loop to frequent bumps and jars.

That said, the Cooler Master Storm Stryker sounds like exactly what you're looking for. It's a full-tower case with a sturdy carrying handle that can accommodate a full, multi-GPU water-cooling loop. Again, though, you'll probably be topping 50 pounds with that kind of setup, so carrying it by the handle probably isn't going to be great for you.

If you're willing to forgo the water-cooling this time, we'd suggest the CM Storm Scout 2 (reviewed February 2013). It's a smaller and lighter case that can still hold an SLI setup, and has plenty of fan mounts—though you'll need to add several fans; it only comes with one. It's around $100, too—$70 cheaper than the Stryker.

One final tip you may not know about are the GearGrip line of products from CaseAce that are designed for LAN gaming. The GearGrip system harnesses are sturdy and can accommodate many different case shapes and sizes as well as your monitor and keyboard, too. Check them out at GearGrip.com.



The CM Storm Scout 2 is a mid-tower case that can hold an SLI gaming rig. And it has a sturdy handle, for lugging it to LAN parties.

Software Free for All!

BY THE MAXIMUM PC STAFF, ALEX CASTLE, AND NATHAN EDWARDS



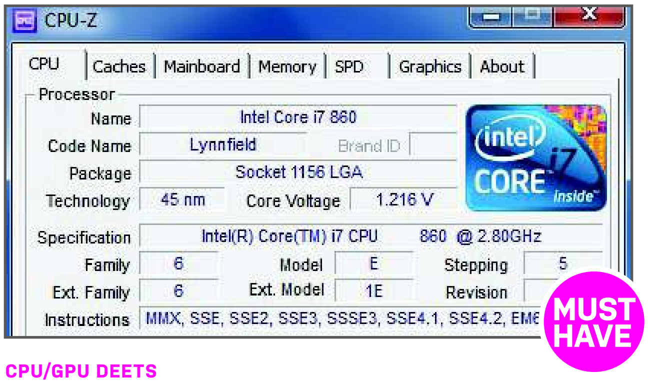
65 PROGRAMS THAT GET THE JOB DONE—GRATIS

Let's face it, there's nothing cheap about being a PC lover. Putting together a badass rig and keeping it up to date takes cabbage, even when we do our best to make value-driven purchases. Luckily, we can offset our hardware indulgences by saving big on software. So many of our daily computing activities—be it work or entertainment—can be accomplished with a totally free program. And we're not talking about second-rate, poor-man's versions of paid-for programs, but perfectly capable, top-notch solutions that stand on their own while costing nothing. There are even some freebie programs that we honestly couldn't live without. Intrigued? Turn the page to learn more.


Notepad++
Dropbox
PDF
WinMerge
Dropbox
filehippo.com
FurMark
SiSoft Sandra
WinMerge
PDF

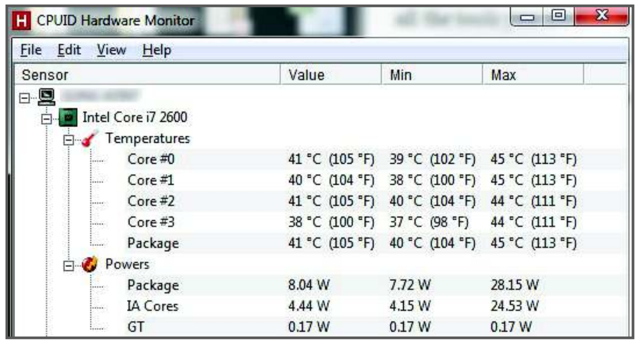
System Information

Keep close tabs on your PC



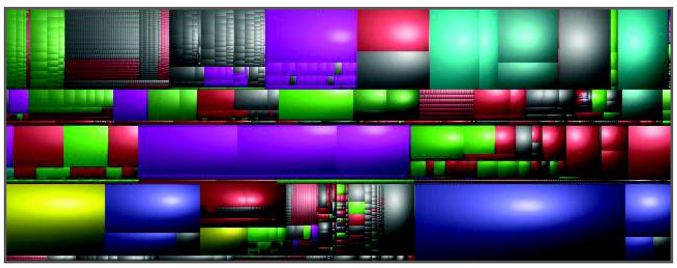
CPU/GPU DEETS

CPU-Z AND GPU-Z If you get trapped on Benchmark Island with just one 4GB USB key of utilities, we hope that CPU-Z and GPU-Z are on it! These two utilities are invaluable for seeking info about your components, and they are so up-to-date we swear that Intel, AMD, and Nvidia are supplying inside info before their parts come out. www.cpuid.com, www.techpowerup.com



SYSTEM TEMPS

HWMONITOR From the same folks who bring you the indispensable CPU-Z comes HWMonitor. This tool gives you an easy-to-use way to monitor most of your system's temperatures, voltages, and fan speeds. It's not the prettiest utility out there but we've found it to be spot-on when we're testing out an overclock and need to monitor the temps. www.cpuid.com



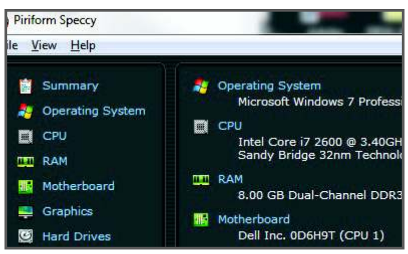
DATA DE-HOARDING

WINDIRSTAT The Real Data Hoarders of Orange County actually use WinDirStat as part of a 7-step program that helps convince data hoarders it's time to clean up that drive. Upon launch, WinDirStat does a survey of the drive's contents and displays it in a colored graph, so you know your massive video collection is that big blue swath on your 2TB hard drive. You can even poke through the different colored squares to see what each file is so you can finally slate it for erasure. www.windirstat.info



TURBO INDICATOR

INTEL TURBO WIDGET Let's not kid ourselves: Intel's Turbo Boost is built-in overclocking. Sometimes, though, it's difficult to discern by how much. Even worse, many of the clock-speed widgets and tools we've tried aren't always correct. We've compared Intel's own Turbo Widget (Turbo Boost Technology Monitor) to the company's internal tools and found it to be one of the more accurate indicators around. www.intel.com



SYSTEM INVENTORY

SPECCY Of the many, many system-info tools available on the PC, we find Speccy to be one of the prettier ones. Brought to you by the same folks who make CCleaner, this simple tool organizes available system info into a very presentable and easy-to-read util and isn't bloated by excess crap that most of us never use. www.piriform.com

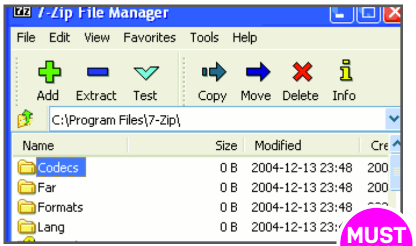


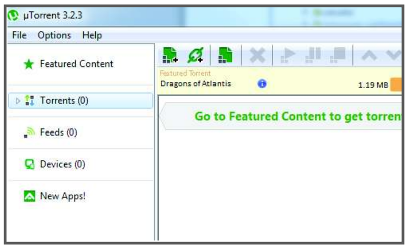
DISK INFO

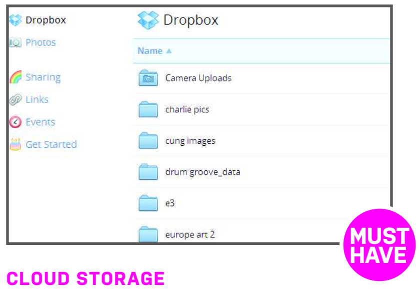
GKRELLM Ported from Linux, this decidedly old-school utility may not impress you at first, but it's one of the more effective tools we've found that lets you monitor the read and write performance of a disk. We've actually compared it to both real-world and synthetic benchmarks for disk I/O and found it to be spot-on, so you know your shiny, new SSD is running at speed. http://bit.ly/ZCjeds

File Management

Your data where, when, and how you like it







FILE ARCHIVER

7-ZIP Why should you pay for a program like WinZip when 7-Zip will expertly manage all your compression needs? The open-source software is completely free and doesn't inundate you with ads. Add to that 7-Zip's support for a wide array of formats (ZIP, ISO, and more) and its compatibility with Windows 8 all the way down to Windows 98, and you'll see why we tell everyone to "Zip it!" www.7-zip.org

TORRENT DOWNLOADER

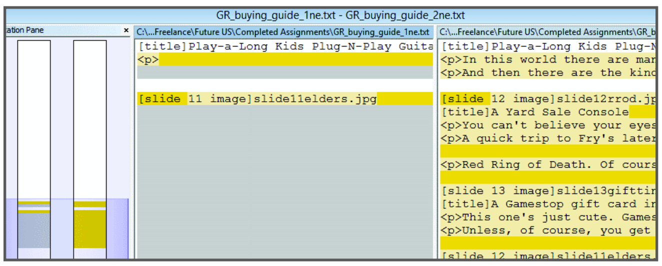
UTORRENT In the event you want to download torrents (the legal ones, of course), we highly suggest using uTorrent. The program is super light at 800KB, easy to use, and isn't a resource hog. uTorrent actually adjusts Internet bandwidth depending on usage. Playing an online game? uTorrent will intelligently throttle its upload/download speeds so you can both enjoy your gaming and download your files. U should try it. www.utorrent.com

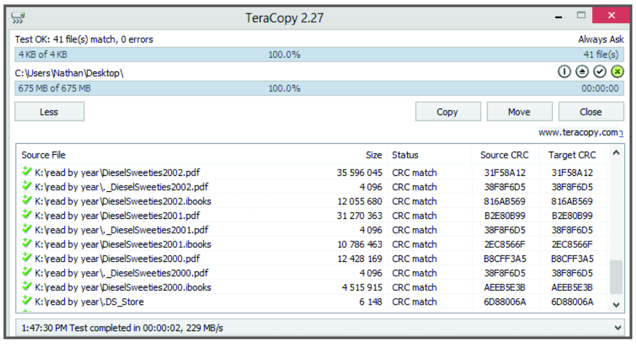
CLOUD STORAGE

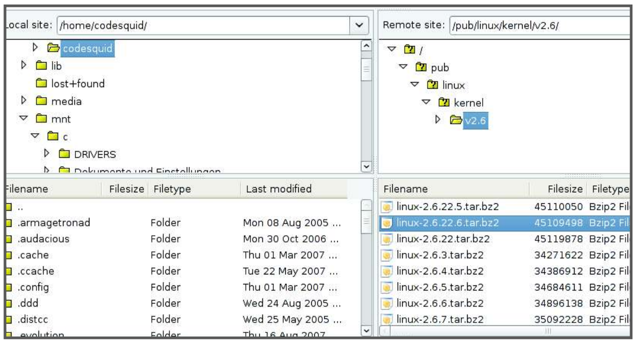
DROPBOX Not only does Dropbox offer free storage, but because it's a cloud-based system, you'll be able to access your saved data from any online device. It also works great if you want to back up important documents (in case your local storage drops out on you). While you only get 2GB free when you sign up, you can get up to 18GB by referring Dropbox to your friends. www.dropbox.com

FILE MANAGEMENT

WINMERGE Got multiple versions of what you hope are the same file? Do you want to check a download for errors? Want to merge changes from one version of a document to another? Or do you want to check two entire folders to make sure their contents are exactly the same? WinMerge does it all. It's incredibly useful for bit-level change detection, or just making sure local and remote folders (and their contents) are synced correctly. www.winmerge.org







COPY & MOVE

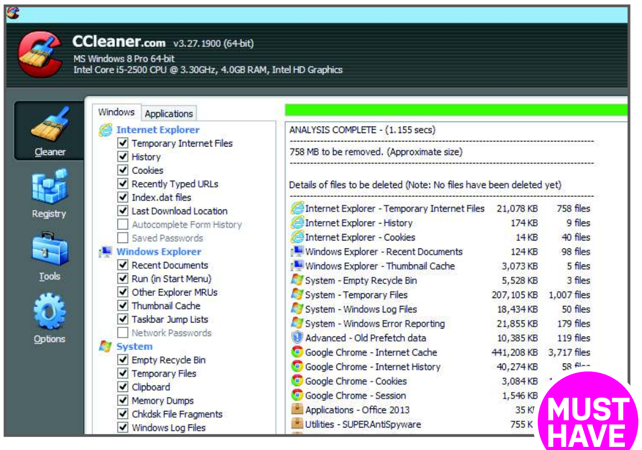
TERACOPY TeraCopy is a robust replacement for Windows' file transfer system. It's not just faster than Windows' file copy system, it's better—it shows exactly which files have transferred and which are queued, as well as transfer speed. It lets you pause and resume transfers and can even do a before-and-after file hash comparison to make sure everything copied correctly. http://bit.ly/rCXsWy

FTP SOLUTION

FILEZILLA Transferring large files? Let open-source file-transfer-protocol (FTP) program FileZilla help you. FileZilla can act as both an FTP client and server. You can transfer up to 4GB files, and because you can drag-and-drop folders, it's really easy to use. FileZilla also runs on a variety of operating systems including Windows, Linux, and Mac OS X. http://filezilla-project.org

Maintenance

An orderly system is a productive system





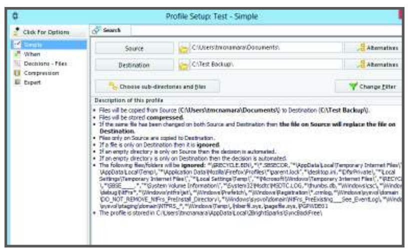
SYSTEM CLEANUP

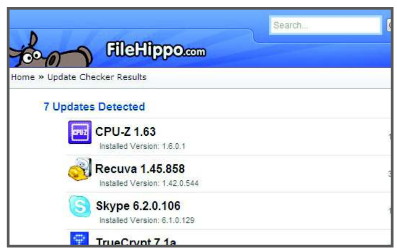
CCLEANER Imagine the Disk Cleanup feature in recent versions of Windows, then crank it up to 11. CCleaner doesn't restrict itself to removing cruft that's generated by the OS. No, sir. It can also reach out and touch Chrome, Firefox, Adobe Flash, McAfee, and GIMP, among others. It also contains one of the few reliable and legitimate registry cleaners on the market (though you should always make a backup of that before modifying it), it will scrub your Master File Table, and it can act as a replacement for Add/Remove Programs (aka Programs and Features in Windows 8) and MSConfig. CCleaner is basically a Swiss Army Knife of desktop management, in an easy-to-understand package. The free version does not provide customer support from the developer. But considering what it's capable of, we can't complain. www.piriform.com/ccleaner

PROGRAM REMOVAL

REVO UNINSTALLER If you're looking for something more specialized, Revo is another genuine article in a sea of potentially sketchy competitors like PC "optimizers" and RAM defragmenters. It has some overlap with CCleaner, but since both programs can be had for free (legitimately), it never hurts to run the same commands on both, in case one notices things that the other does not. At least, it doesn't hurt when the operations are fast, and they are. With a speed that borders on sorcery, Revo will scan your whole system for things that it can wipe from the face of the earth. In terms of specialization, Revo can look up a website associated with an installed program, identify its registry key, find its program folder, and even set up a Google search for the program name. www.revouninstaller.com







DRIVER UPDATES

SLIMDRIVERS FREE Windows usually lets us fly solo in the quest for updated hardware drivers. If you prefer a guided process, SlimDrivers Free will scan your system and ask the Internet if your stuff has updates. To minimize shenanigans, it will offer to create a restore point, create backups of your old drivers, schedule the scanning process, and even look out for potential conflicts. The dev is also certified by Microsoft. www.slimwareutilities.com

BACKUP AND SYNC

SYNCBACKFREE The venerable SyncBackFree is on the verge of marking its tenth year on the market. Possible reasons: Every command is explained in plain English. Options are nested in subfolders to keep the user from being overwhelmed. The backup/sync process can be highly automated, with email notifications, FTP, and network integration, and specific programs triggered before *and* after a sync or backup. It'll make you feel like a wizard. http://bit.ly/8qX6a

SOFTWARE UPDATER

FILEHIPPO Let's admit it, keeping on top of application updates for your smartphone, whether for security or bug fixes, is easy, the way they all show up in one place. Wouldn't it be nice if the PC had that? Oh yeah, there's an app for that. Just run FileHippo's Update Checker, which quietly checks your installed apps for any available update, including beta updates. www.filehippo.com

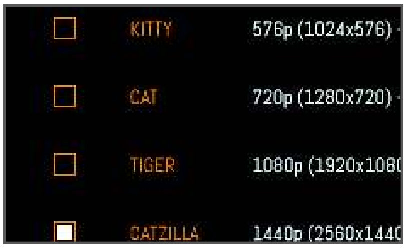
Benchmarking

Measure your system's performance



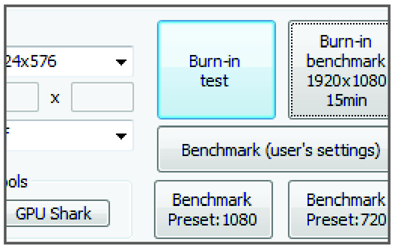
TESSELLATION TESTING

UNIGINE HEAVEN Unigine Heaven 4.0 has quickly grown into one of the most popular tools for testing a GPU's DirectX 11 prowess, particularly in tessellation. There are paid versions of the tool, including a professional version for commercial use, but for most enthusiasts the free one will give you all the info to know if your GPU is up to snuff. www.unigine.com



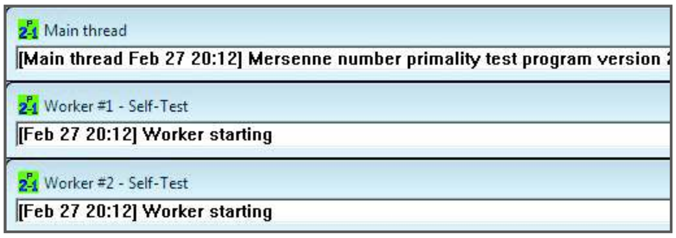
GPU BENCHMARK

CATZILLA Our own Senior Editor Josh Norem is a major league cat-lover, so it's no surprise that AllBenchmark's Catzilla makes the cut as one of the purrfect benchmarks to stress the bejesus out of your GPU. The tool lets you test your GPU in Kitty, Cat, Tiger, or Catzilla mode. If there's a cat metaphor we haven't scratched yet, just let us know. www.allbenchmark.com



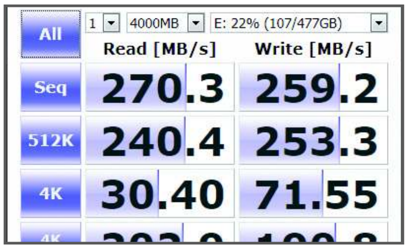
GPU STRESS TESTING

FURMARK FurMark used to be a popular performance benchmark but once AMD and Nvidia started to optimize for it, it fell out of favor. It is, however, still a damned-good tool for torture testing a GPU. So, if you're validating your GPU overclock or looking to stress-out the thermals in your case, FurMark is effective and free. www.geeks3D.com



CPU STRESS TESTING

PRIME95 To test an overclocked CPU, we turn to Prime95. It's one of the top tools for quickly validating a fresh overclock. Some would argue that it's too hard on a CPU, but we feel that if your overclock will withstand Prime95 for a few hours, it's probably pretty damned stable. You may want to go overnight or even 24 hours if you are truly into torturing your system, though. http://bit.ly/LnCXq



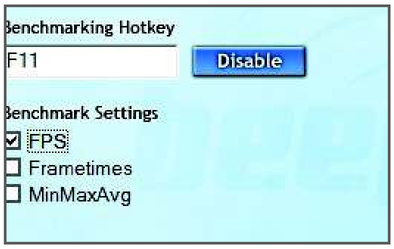
SSD BENCHING

CRYSTALDISKMARK Storage devices can be the most difficult to measure without the use of synthetic benchmarks. CrystalDiskMark, however, has proven to be fairly accurate for pure sequential-read and -write performance. We recently kicked up our real-world video disk write test and the results closely matched CDM's. http://bit.ly/4IefV6



RAM TESTING

SANDRA 2013 Memory benchmarks get no love because memory bandwidth doesn't move the meter much in the vast majority of games and applications (except when using integrated graphics). Still, it's nice to know that your DDR3/1866 sticks are actually performing where they should be. Plus, a quick test will tell you whether your RAM is configured correctly. www.sisoftware.co.uk



REAL-WORLD GAMING

FRAPS 3DMark, Heaven 4.0, and Catzilla are meaningless if you don't know how fast your games are actually running. FRAPS is the world-wide accepted standard for measuring in-game, real-world performance—even in games that don't support benchmark modes. Just fire up FRAPS, pick your game settings, and play. FRAPS will display the current frame rate of the game as you frag away. www.fraps.com

BEST FREE GAMES

A desire to save money doesn't have to get in the way of your good time

TEAM FORTRESS 2: The team-based, class-based TF2 redefined fashion for a legion of hatless heads, and it's an entertaining game in its own right, with balanced weapons and multiple game types (CTF, deathmatch, and a few unique ideas). You'll also get momentum from the occasional random unlock, many of which you can trade or even sell for Steam wallet funds. www.teamfortress.com



TRIBES: ASCEND: Similar to TF2, this game distinguishes itself in one of the best ways possible: jetpacks! Everybody gets one. You'll also navigate across the map on skis, sometimes at ridiculously entertaining speeds. Projectiles are actual physical objects, though, so there's some nuance to the shooting and exploding. You can unlock gear over time, or with real money. http://bit.ly/Zcs82F

QUAKE LIVE: Back in the '90s, id Software was king of the first-person shooters, and Quake was a cornerstone franchise. Quake Live, based on Quake 3 Arena, is an online-only multiplayer extravaganza of over 40 maps and five game modes. It won't compete on visuals, but veterans of the genre regard the balance of weapons, maps, and movement as some of the best ever created. www.quakelive.com



LEAGUE OF LEGENDS: League of Legends is the most popular PC game today for good reason: It's insanely fun and addictive. The cooperative strategy game pits two teams of five against each other and has you working with your allies to destroy the enemy base. www.leagueoflegends.com

BLACKLIGHT RETRIBUTION: Shooting games on the PC are a dime a dozen; good, free-to-play shooters, however? Not so much. Luckily, there's Blacklight Retribution, a gorgeous-looking, futuristic shooter that will make you feel at home if you're a fan of the Call of Duty series. The game offers great shooting mechanics and a ton of awesome weapons. http://blacklight.perfectworld.com

DOTA 2: If you already tried League of Legends but are looking for something a little more complex and challenging, check out Dota 2. The game is a sequel to the original multiplayer online battle arena (MOBA), Defense of the Ancients, with the biggest difference being that it got a huge graphical overhaul thanks to Valve and its source engine. www.dota2.com



PLANETSIDE 2: PlanetSide 2 really emphasizes the "massive" in massively multiplayer online shooter. The game makes the battlegrounds in Battlefield 3 look tiny by comparison. PlanetSide 2 features three different factions with a plethora of classes and has you vying for territorial control (à la RISK). A variety of awesome vehicles help you traverse the vast terrains. www.planetside2.com

SMITE: If you're looking for a MOBA with a refreshing twist, check out Smite. It's a lot like Dota 2 and LoL, only in third person. Gameplay still includes same minion, tower defense, and base-destroying mechanics, but Smite feels much more action-oriented because all of your attacks are now skill-based shots. http://bit.ly/YwHDye

DC UNIVERSE ONLINE: With the scads of subscription-MMOs-turned-free-to-play options around, how do you choose which one to play? Easy—you pick the one with Batman. And if Batman isn't enough (as if *that* were possible), DC Universe Online also features action-packed arcade gameplay and a ton of content to play through without paying a thing. www.dcuniverseonline.com



DAGGERFALL: If you find Skyrim just a little too high-fidelity, maybe you should try getting in touch with your roots. No, not Oblivion or Morrowind—we're talking about Daggerfall. The second in the Elder Scrolls series, Daggerfall remains its most expansive entry, with 188,000 square miles of virtual terrain and thousands of towns and dungeons to explore. www.elderscrolls.com/daggerfall

MIDDLE MANAGER OF JUSTICE: If we tell you that Middle Manager of Justice is a business management game, with microtransactions and timer-based gameplay, you might think it sounds like every other F2P game. But when you hear that this F2P game was released by Tim Schafer's Double Fine, and puts you in charge of a superhero company, maybe you'll agree that it's worth a try. www.middlemanagerofjustice.com

Content Creation

Make cool stuff with your PC



PHOTO EDITOR

GIMP This photo-editing software might be called GIMP, but it is anything but hobbled. The powerful, in-depth program allows you to retouch photos with a variety of color correction options (hue, saturation, color balance), do free-form drawing, and resize/crop images. It's certainly a step above Microsoft Paint and even gives Adobe Photoshop a run for its money. www.gimp.org

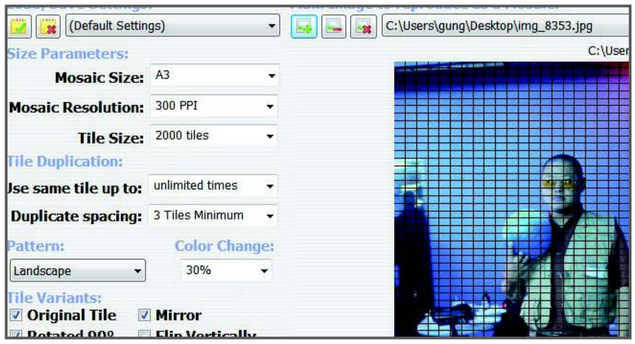
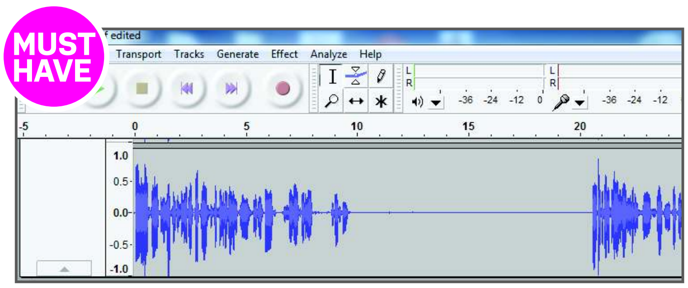


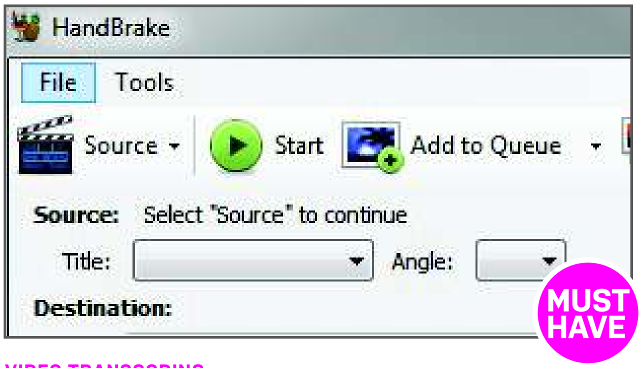
IMAGE CREATION

ANDREAMOSAIC You've got gigabytes of freeloading images on your HDD, why not put them to work? That's what AndreaMosaic can do for you. The app lets you take your wads of pics and assemble them into an impressive photo mosaic. The free version lets you make mosaics of up to 200 megapixels with up to 30,000 tiles using 100,000 images. www.andreaplanet.com



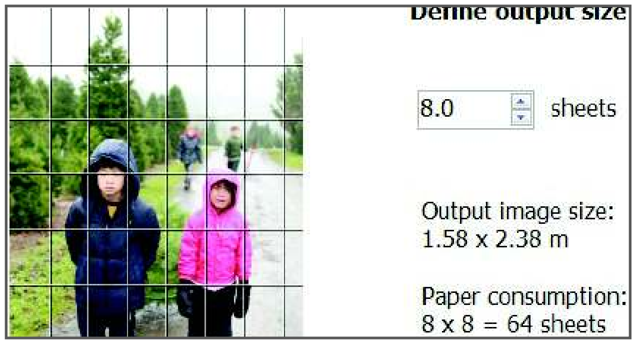
AUDIO EDITOR

AUDACITY Whether you're a hardcore musician or just someone who wants to record a podcast, Audacity is a great all-around audio-editing program. In addition to being easy to use, it includes a wide array of editing options and filter effects such as reverb, delay, and more. And if you are the type who likes to keep things simple, you won't find a free program that makes cutting, pasting, and phasing-out audio easier than Audacity. It would be audacious not to download it. http://audacity.sourceforge.net



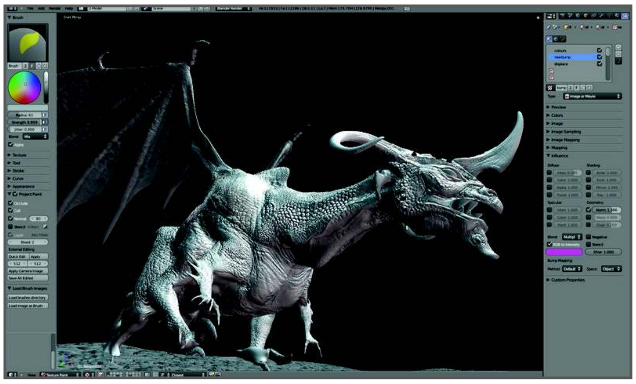
VIDEO TRANSCODING

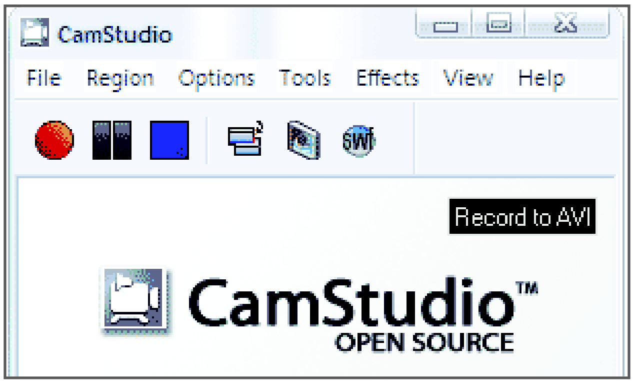
HANDBRAKE HandBrake is an amazingly powerful and flexible transcoder. Even better, it's highly optimized for multiple cores and we even use it to benchmark CPUs on occasion. It doesn't include any ripping ability to convert DVD or Blu-ray discs that you own to flexible, portable formats, but—*cough*—combined with the not-free AnyDVD, HandBrake produces amazingly high-quality files for free. www.handbrake.fr



POSTER PRINTING

RASTERBATOR It's not true, Rasterbation doesn't cause blindness, but it will use all of your toner when you turn your images into gigantic, tiled, rasterized images capable of covering a wall or your house even. The latest version of Rasterbator spits out the images into a convenient PDF so you can even take them to school or work to print out instead. http://arje.net/rasterbator



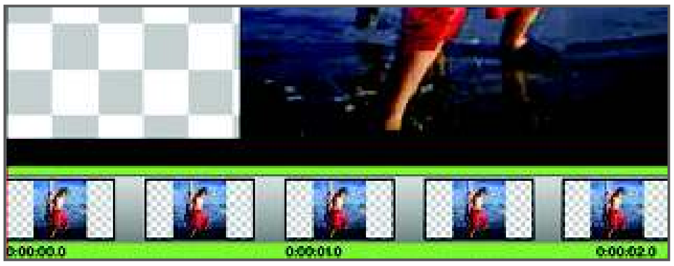


3D MODELER

BLENDER Whether you want to render 3D models for games or CG movies, the powerful, open-source 3D computer graphics software Blender has you covered. However, with great power comes great responsibility, and in this case your responsibility will be to spend the time to learn how to master the incredibly complex program. However, once you do get past the steep learning curve, you'll be able to apply texturing, rigging, and compositing to your intricate 3D models like a pro. www.blender.org

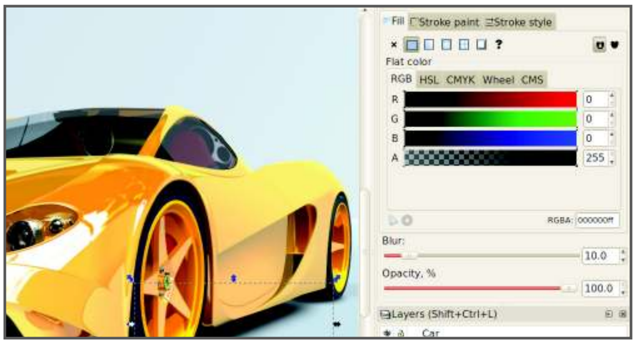
VIDEO CAPTURE

CAMSTUDIO Ctrl + Print Screen is good for capturing screens of your desktop, but what if you wanted a program to capture video? The open-source program CamStudio not only captures video, but audio as well. It converts this format into AVI files and has a built-in Streaming Flash video converter in case you want to quickly upload your videos to YouTube. Check out our How To on page 62. http://camstudio.org



VIDEO EDITOR

VIDEOPAD If you're looking to step up from Windows Movie Maker, VideoPad is a great solution. This fully featured video-editing program has over 50 effects and transitions that will give your videos an extra layer of polish. VideoPad Video Editor is also easy to use and allows you to drag-and-drop videos to the editor's timeline. http://bit.ly/glUz





VECTOR GRAPHICS

INKSCAPE GIMP, like Photoshop, is great for image manipulation and design, but sometimes raster artwork just isn't right for your needs. If you're making a logo, or anything else that you want to look good at any size, you want vector art. The standard tool for making vector art is Adobe Illustrator. However, if you're on a budget, try Inkscape—the open-source alternative. The interface is plainer and it's missing a couple of advanced features, but Inkscape has everything you need for 99 percent of vector tasks, for 0 percent of the cost. http://inkscape.org

SCREENCASTING UTILITY

OPEN BROADCASTER SOFTWARE One of the biggest trends in gaming over the last few years has been screencasting—broadcasting your screen online in real-time as you play. Whether you're a pro or just getting started, it's a great way to get feedback. To get started with screencasting, try Open Broadcaster Software. It's got all the tools you'll need to stream anything, including full-screen games, windowed games, and even your desktop. http://obsproject.com

Security

Keep your data safe



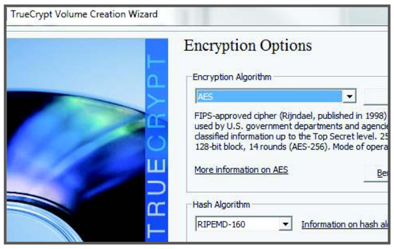
ANTIVIRUS

AVAST FREE VERSION 7 Getting on the Internet without AV is like jumping into shark-infested waters smothered in steak sauce—not pretty. Not even misers have an excuse for taking this kind of risk. As we learned in last month's antivirus roundup and again in this month's Head to Head (page 16), Avast trumps other free AV solutions with a high level of fine-grained control and extreme competence at thwarting infections. www.avast.com



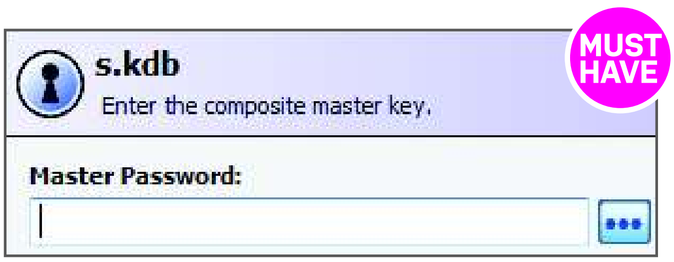
ON-DEMAND SCANNER

MALWAREBYTES ANTI-MALWARE With the bad guys working round the clock to find system vulnerabilities, even the best AV scanners can fall down on the job from time to time. Malwarebytes Anti-Malware is there to give them a hand. This on-demand AV scanner is an effective second line of defense against any unwanted intruders your primary AV might have missed. www.malwarebytes.org



ENCRYPTION

TRUECRYPT You can never be too careful with your personal data, lest you discover that someone posing as you is trotting the globe on your nestegg and soiling your good name in the process. When it comes to highly sensitive files, we put our trust in TrueCrypt. With it, you can easily create encrypted volumes and/or partitions—using your choice of first-rate encryption—in which to hide your private files. www.truecrypt.org



PASSWORD MANAGEMENT

KEEPASS PASSWORD SAFE Raise your hand if you use the same couple of passwords for everything. That's nothing to be proud of, buddy. Do the right thing and download KeePass Password Safe. This easy-to-use database lets you store and manage numerous passwords and other account-relevant notes—all of which are kept safe behind a single master password and Twofish and AES encryption. Hint: Keep your KeePass database on Dropbox, so you can access it from any computer. www.keepass.info

Free Mobile Apps that Interact with Your PC



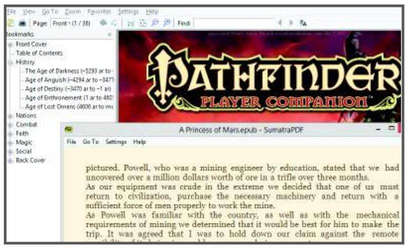
PC MONITOR This app lets you monitor up to five PCs on a network, for things like CPU usage, available RAM, and running processes. You can also send commands like shut down, restart, or force a program to close. Plus, there's a variety of real-time notifications for things like low battery levels, computers turning on or off, case fans spinning slowly, and high temperature warnings. Skynet-approved! http://bit.ly/zbxV3v



AIRDROID This ditty of an app uses Wi-Fi to turn your desktop into a phone interface. You can drag-and-drop files to your phone, share a clipboard, send URLs straight to your phone browser, stream media from your phone to your desktop, send SMS messages from your PC, manage apps, and a few other things. As a bonus, no desktop client is required. It works in your browser. www.airdroid.com

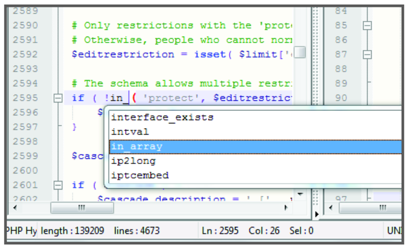
Documents

You don't need no stinkin' Office



PDF READER

SUMATRA PDF But wait, you say. Adobe Reader is already free! Why do we need a free alternative? Well, for starters, SumatraPDF is incredibly speedy and lightweight, it doesn't require frequent security updates, and it won't try to install AskJeeves. Add in the fact that it reads not just PDFs but mobi and ePub ebooks, as well as CBR and CBZ archives, and you've got a winner. http://bit.ly/aHICnC



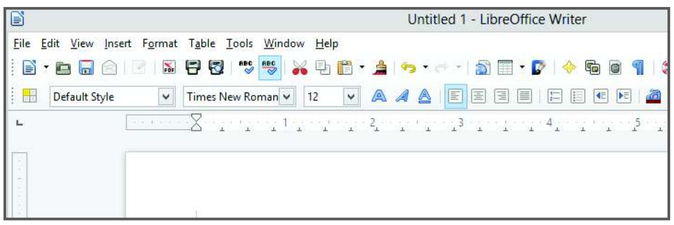
PLAINTEXT EDITOR

NOTEPAD++ Though the sheer mass of features in modern word processors can be intoxicating, sometimes a plaintext editor is the right tool for the job. But just because you're using plaintext doesn't mean you should suffer '90s-era Notepad.exe. Instead, get Notepad++, which offers tabbed editing and a powerful, flexible suite of features for editing and displaying plaintext. Programmers will like Notepad++'s support for syntax highlight, formatting, and autocompletion. http://notepad-plus-plus.org



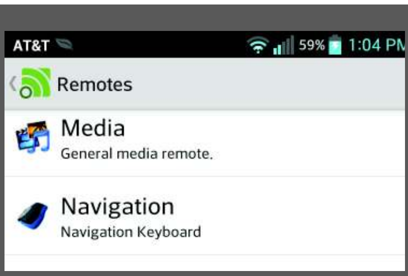
LIGHTWEIGHT WORD PROCESSOR

ABIWORD If you're just looking for a word processor that's fast, lightweight, and feature-rich, you should check out AbiWord. It doesn't have the full-suite integration of LibreOffice, but it does have everything you need to edit any Word document, and includes a set of excellent online-collaboration tools. In addition, the install is much smaller than LibreOffice, and uses a lot less of your CPU when it's running. www.abisource.com



OFFICE SUITE

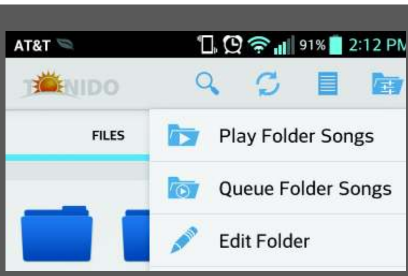
LIBREOFFICE The cream of the free-office-suite crop, LibreOffice even gives MS Office a run for its money. Besides being free, it's open source, interoperable with all the major formats (including the latest Office .docx stuff), and did we mention it's free? Version 4.0 just came out. If you don't mind the more classic interface (no Ribbon here) and like the fact that it's FOSS, you'll love it. Beats shelling out for Office any day. www.libreoffice.org



UNIFIED REMOTE As its name implies, this app can turn your Android or Windows phone into a kind of wireless mouse for your PC, via Wi-Fi or 3G. It also has application-specific controls (Spotify, Chrome), a file browser to open media and documents on the target desktop, and a general-purpose media player. It's handy for presentations (or using your PC as a stereo—since it's Wi-Fi, line-of-sight doesn't matter). www.unifiedremote.com



ES FILE EXPLORER By default, your Android phone doesn't show you all the folders and files under the hood. Unlike Unified Remote, ESFE will play remote media on your phone and also connect to FTP and Samba servers and a number of cloud storage services. It works over Wi-Fi, 3G, 4G, EDGE, and even Bluetooth. If your phone is rooted, you can also see every system file and folder. bit.ly/pAWdJs



TONIDO Tonido is a cloud storage service that syncs a remote PC to your iPhone, Android phone, or recent versions of Windows, Mac OS, and Linux. You can access this remote PC directly and upload up to 2GB of its data to your Tonido account (you can get more space for a nominal fee). Like AirDroid, it works in your desktop browser instead of using an external client. www.tonido.com

Media Handling

Master your music, videos, and pics

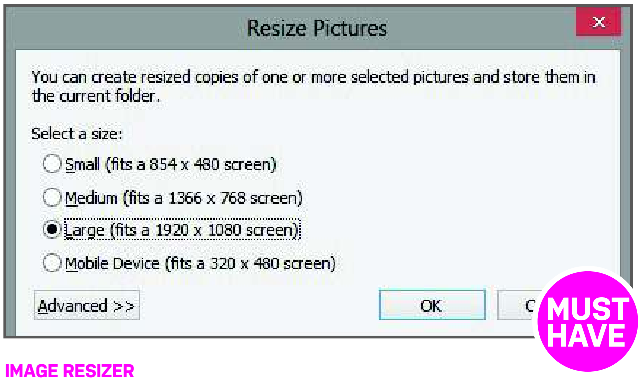
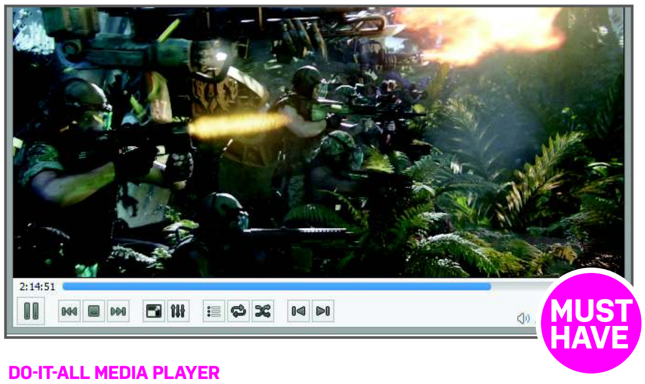


IMAGE RESIZER

IMAGE RESIZER Nowadays, even the pics from our phones are too big to email and/or post to Facebook and Twitter, and don't even get us started on a DSLR's files. We find ourselves resizing pics quite often to enable faster uploads, and for that we use Image Resizer. This free plugin offers three resize options, integrates into the Windows Shell, and is easy to use. www.codeplex.com



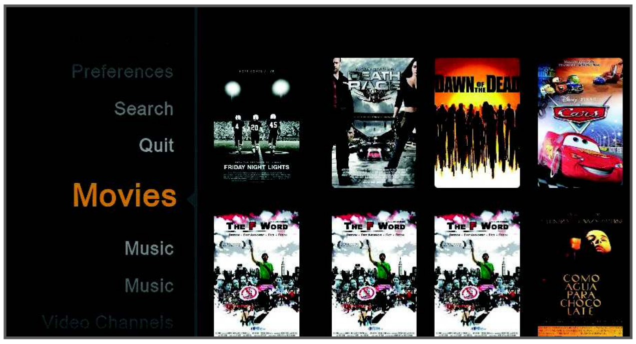
DO-IT-ALL MEDIA PLAYER

VLC MEDIA PLAYER VLC is software that needs no introduction—in case you've never heard of it, stop reading and get to downloadin' STAT. This do-it-all media player will open almost any file you throw at it including obscure file types found in the nether regions of the Internet. If VLC is too "commercial" for your hipster tastes, go with Media Player Classic for extra online cred. www.videolan.org



MUSIC PLAYER

AIMP Since WinAmp hasn't seen any major developments in years, you may be looking for something fresh that isn't iTunes. AIMP is lightweight, can record audio streamed through a browser, and sports LastFM and other Internet radio integration, an 18-band equalizer with preamp and custom presets, tabbed playlists, a tag editor, and an audio converter. However, it does not do RSS feeds or CD ripping (yet). www.aimp2.us





MOVIE SERVER/PLAYER

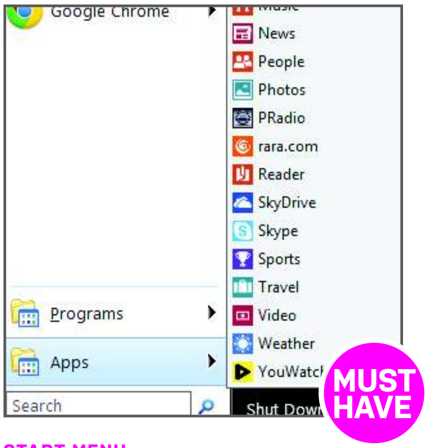
PLEX Plex is our favorite free software that includes both a media player for wireless clients and server software for our HTPC. It's a fork of the excellent XBMC and improves upon it with better device support and the ability to dish data to any and all clients in the home. Install the PleXMBC add-on for the best of both worlds. www.plexapp.com

IMAGE ORGANIZER/EDITOR

PICASA 3 Picasa rocks because it's free, easy to use, and offers powerful editing and cataloging options, as well as easy-to-use tools to create content from your photos. It can handle massive picture collections and functions as a slick image viewer, too, even letting you do side-by-side image comparison. It also integrates with Google+, if you're into that sort of thing. http://picasa.google.com

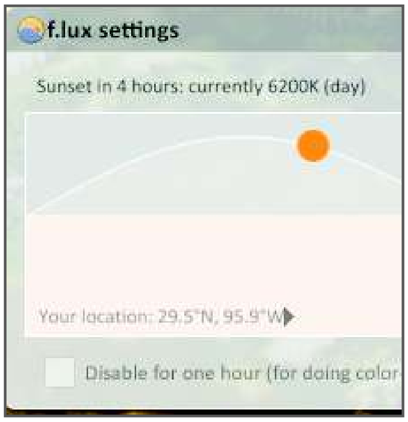
Look and Feel

Optimize your desktop's appearance



START MENU

CLASSIC SHELL If the move to Windows 8's Start screen left you confused and missing the old Start button, fear not. Use Classic Shell to put that Start Menu back in the lower-left corner of your desktop where it belongs. It comes in many flavors, including Classic, XP, and Vista/Win 7, and is skinnable, to boot. The best part is that it disables the Start screen while still letting you use Metro apps, unlike some of its peers. But seriously, the Start screen isn't that bad. You babies. www.classicshell.net



SAVE YOUR EYES

F.LUX Looking at a bright screen all day can strain your eyes, and if you're looking at it after dark, the bluish light can even screw with your sleep schedule, making you stay up later. F.lux lets you give your eyes a break by adjusting the color temperature of the screen based on the time of day. After sunset, the screen gets warmer and softer, so your eyes don't have to work as hard. You can disable it for color-sensitive work. Once you try it, you'll never go back. http://stereopsis.com/flux



MONITOR MANAGEMENT

DISPLAYFUSION Windows 8 is much better at multi-monitor management than its predecessors, but there's still room for improvement. DisplayFusion lets you set desktops independently, gives you much more control over which programs open on which monitor, creates a much better taskbar, and includes compatibility for Classic Shell and other Start screen replacements. It's the king of the multi-monitor management world. www.displayfusion.com

The Sucky Side of Free Software

We all love free software, but it's becoming increasingly a pain in the tuchus to just download the software, use it, and never encounter any issues. The first issue is just trying to download the damned software, since most pages put up "fake" download buttons that cause you to download a totally different program than the one you want, so be vigilant downloaders. Once you navigate the download-button minefield and actually get the software, it will then prompt you 10 ways from Sunday to install all kinds of crapware that will hijack your browser's search engine and home page, and color your hair without your permission. Again, be vigilant, as they'll often use trick questions to get you to install the extra software, like, "Do you want to meet single women and install this software?" It's gotten so bad that there is a version of Chrome in the works that will alert you when installing software if any changes are being made to your browser, because even the best of us have let down our guard momentarily and suddenly been confronted with Coupon Buddy.

If you make it past these hurdles, you might then be confronted with guiltware asking you to upgrade to the full version, or for freeware reminding you that you need to pay for it at some point (WinRAR, anyone?) Sadly, this is the true cost of "free" software these days.

Nvidia Summons the Titan

New flagship single-GPU graphics card is so badass it doesn't even have a number. It's just Titan. Here's what else you need to know

BY JOSH NOREM



BACK IN AUGUST 2012, when the GeForce GTX 690 debuted, we asked the question, "Where is Big Kepler?", which went unanswered until now. You see, when Nvidia launched its all-new Kepler architecture last year, it did so with two GPUs: the mid-size GK104 for the gaming market, and the full-size GK110 for the supercomputing world. The GK104 chip ended up in the GTX 680 flagship GPU, and the GK110 ended up in the Tesla K20X GPU, which was sent off to toil in labyrinth supercomputers the world over, most notably the Titan supercomputer at Oak Ridge National Laboratory. Though we've all enjoyed the company of the GTX 680, and it's been able to fend off any advances from AMD's HD 7970 Tahiti GPU, as connoisseurs of Pure PC Power we've nevertheless wondered what a gaming GPU based on the massive GK110 GPU would be like—we just figured its size and cost would prevent Nvidia from offering it to the unwashed masses. As it turns out, we were wrong. Nvidia has done exactly that, taking the super-sized GK110 GPU found in the Titan supercomputer and turning it into an outrageously priced and spec'd gaming GPU that's so unique it's even named differently, bucking the standard number scheme. It's not the GTX 780 or the GTX 680 Ultra, like you might expect. It's simply the GTX Titan. A stand-alone "because we can" video card that is ridiculously fast, unapologetically expensive, and above all, a thermonuclear warhead fired directly across AMD's bow.





Big Kepler has finally arrived in the form of the GTX Titan.

THE TITAN'S REASON FOR BEING

We never thought Nvidia would release this GPU to the public. In our 2013 Technology Preview (Holiday 2012 issue) we looked at the GTX 680 and pondered where team green would go from there, stating that the GK110 existed and had been in use for quite a while, but would Nvidia dare to make the quantum leap from GK104 to GK110? No way, we wrote; not going to happen. "It would be totally uncharacteristic of Nvidia to double performance in the next generation," we wrote, "particularly when the competition doesn't warrant it."

We're not afraid to admit we were wrong, and we weren't alone. When asked why Nvidia created Titan, a rep told us it was simply because they could. Since Nvidia already had the GK110 deployed and available, it decided to make the chip into a gaming GPU to support the über-enthusiast crowd, which if you're reading this, means you. Though we all expected a GTX 780 to burst forth from Kepler's loins at this time, instead we got Big Kepler in the form of the GTX Titan. Whether or not that will delay the eventual release of the GTX 680's natural successor is anyone's guess, but Nvidia isn't talking about it right now.



When it comes to length, the 10.5-inch Titan (right) lies in between the GTX 680 (middle) and the GTX 690 (left). It was designed to fit into rigs that can't accommodate the massive GTX 690.

INSIDE THE GK110

Let's take a look at what makes the Titan different from the GTX 680 and what that means for its performance potential. For starters, the Titan's GK110 GPU is a massive upgrade from the relatively small GK104 chip, and has almost double the CUDA cores, from 1,536 in the 680 to a whopping 2,688 in the Titan. Transistor count has doubled from 3.5 billion in the 680 to 7.1 billion in the Titan, with a die size of $551mm^2$. To give that size some context, Intel's Ivy Bridge CPUs (albeit 22nm vs. Kepler's 28nm) have a transistor count of 1.4 billion and an adorable die size of $160mm^2$. By now you can probably understand why the GK110 is referred to as Big Kepler. It's an absolutely massive chip, the likes of which has never been seen on a desktop GPU.

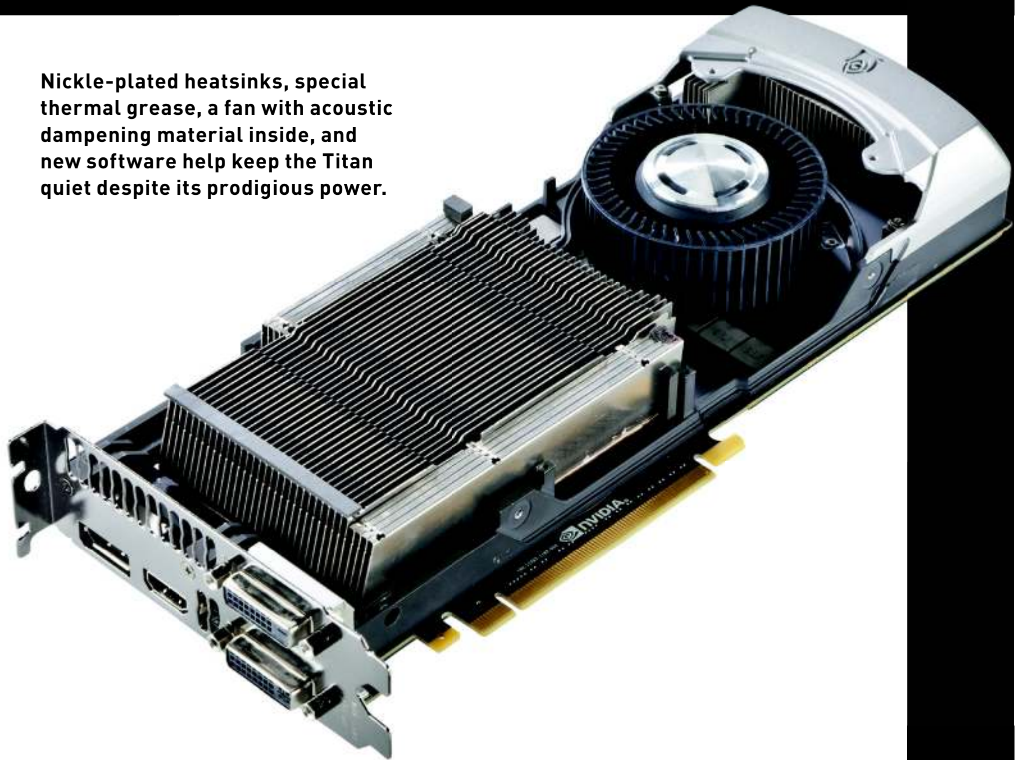
Another first for the Titan is its gargantuan 6GB frame buffer as standard, which is three times as large as the 2GB found on the GTX 680 and twice as big as a stock Radeon HD 7970's 3GB. We know you're probably thinking, "Why would I need 6GB of RAM? That is ridiculous." And you would be correct, you don't need that much RAM if you're running just one display, but that massive frame buffer

SPECIFICATIONS

	GTX Titan	GTX 690	GTX 680	AMD Radeon HD 7970
Number of Cores	2,688*	3,072*	1,536*	2,048*
Texture Units	240	256	128	128
ROPs	48	64	32	32
Base Clock Frequency	836MHz	915MHz	1,006MHz	1,000MHz
Boost Clock Frequency	876MHz	1,019MHz	1,058MHz	NA
Memory Clock Frequency	1,502MHz actual	1,502MHz actual	1,502MHz actual	1,375MHz
L2 Cache Size	1,536KB	2x 512KB	512KB	768KB
Frame Buffer Size	6GB	4GB	2GB	3GB
Memory Interface	384-bit	2x 256-bit	256-bit	384-bit
Manufacturing Process	28nm	28nm	28nm	28nm
Transistor Count	7.1 billion	2x 3.5 billion	3.5 billion	4.3 billion
Connectors	2x DL-DVI, HDMI, DisplayPort 1.2	3x DL-DVI, Mini-DisplayPort	2x DL-DVI, HDMI, DisplayPort 1.2	2x Mini-DisplayPort, DL-DVI, HDMI 1.4a
Power Connectors	1x 6-pin, 1x 8-pin	2x 8-pin	2x 6-pin	1x 6-pin, 1x 8-pin
Thermal Design Power (TDP)	250w	300w	195W	250W

* AMD and Nvidia graphic compute cores are not directly comparable.

Nickle-plated heatsinks, special thermal grease, a fan with acoustic dampening material inside, and new software help keep the Titan quiet despite its prodigious power.



helps immensely when running multiple displays, something the Titan was born to do thanks to its quad-SLI support. Access to all that memory is improved over the GTX 680 even though the Titan is clocked at the same 6GHz—it's just got the addition of a wider 384-bit memory bus, which allows for a total of 288GB/s of memory bandwidth compared to the GTX 680's 192GB/s, a substantial improvement.

The Titan has the same number of SMX units as the burly Tesla K20X: 14 (the GTX 680 has eight), and each has all six ROP partitions intact. Each of these functional units has its own 64-bit memory controller and eight ROPs, for a total of 48 ROPs and 240 texture units compared to the GTX 680's 128 texture units, so again it's a sizable increase. Since the GK110 is a much larger GPU than the GK104, the Titan's clock speeds are a bit slower in order to keep temperatures in check. However, more cores running slower will still surpass fewer cores running faster (just ask AMD about this). In stock trim, the Titan runs at a cool 836MHz, with a boost clock of 876MHz, which is 170MHz slower than the GTX 680's 1,006MHz clock speed. It should also be pointed out that the dual-GPU GTX 690 runs at 915MHz, so the Titan is the slowest-clocked but most massively parallel GPU yet to come out of Nvidia's labs. To put some numbers on it, the Titan has an overall fill-rate of 187.5 Gigatexels compared to the GTX 680's 128.8 Gigatexels, and when it comes to compute performance, the Titan is capable of processing 4.5 teraflops compared to the GTX 680's 3.0 teraflops, so it's a dramatic improvement in compute ability. We'd also be remiss if we didn't mention that the Titan's TDP is a mere 250W, just 55W higher than the GTX 680 and the same rating as the HD 7970, despite being much, much faster.

COOLING AND CHASSIS

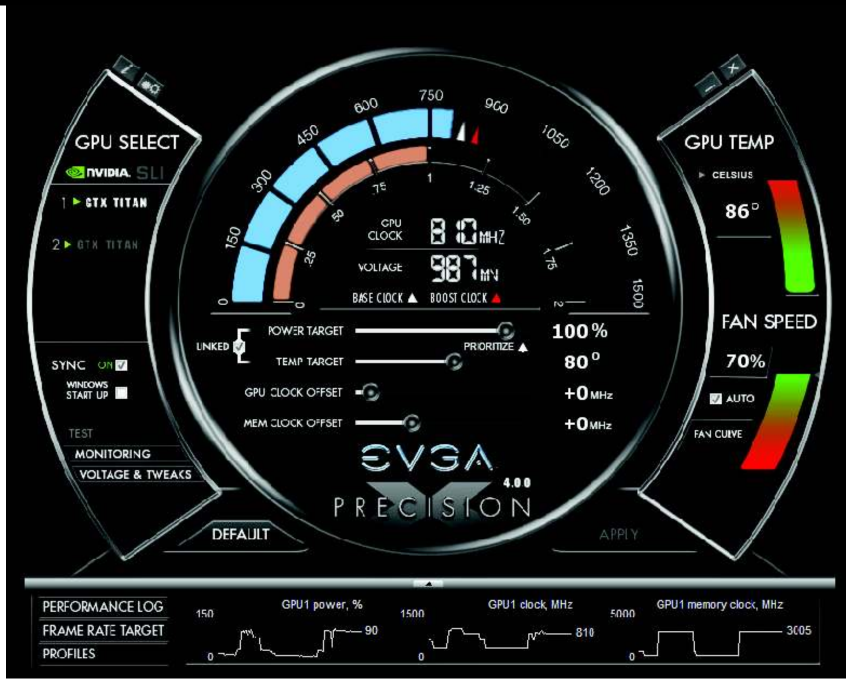
One of the primary benefits of Nvidia's Kepler architecture is that it's super efficient, so it doesn't require a lot of power or produce as much heat as its competition, and we're happy to report that not only is the Titan just as quiet as the GTX 680 despite being more powerful, but in some scenarios the Titan is actually *quieter.* Nvidia achieved this impressive feat using a combination of hardware and software (details below), and told us that acoustics are now a top priority for the company, as its customers have made it very clear they don't want a noisy GPU ever again. You would think Nvidia learned this lesson long ago after leafblower-gate (http://bit.ly/4eI74), but we digress.

The cooling apparatus on the Titan sports several all-new bits and is composed of four parts, the first of which is an aluminum baseplate surrounding the GK110 that helps move heat away from the GPU and the surrounding components and into the vapor chamber that sits on top of the GPU. Helping transmit that heat is a new thermal paste that Nvidia says is twice as conductive as the material it used on the GTX 680. A rep couldn't give us the exact type of paste used, but did say it was made by a Tokyo-based company named Shin Etsu. Once the heat is transferred to the vapor chamber, it then moves to a dual-slot aluminum heatsink that's nickel-plated and runs from the top of the card to the bottom (we mean like right to the very edge). Air is circulated through the cooling mechanism by a fan that uses acoustic dampening material in its design, and the card's heat is exhausted out the back of the case, as opposed to the way the GTX 690's centralized fan sends part of the hot air into your case. The reason for keeping the card as cool as possible is that the GPU clock speeds are now tied to card temperature for the first time (more on this in the next section), so by keeping the card running cool, clock speeds can run higher, resulting in higher overall performance.

The outer shell of the Titan features a laser-cut GeForce GTX logo that lights up, just like on the GTX 690. The difference is that now it can be controlled via software, shining brighter as GPU utilization increases, or changing color based on the temperature of the card. The rest of the card's shell looks like the GTX 690, with aluminum and see-through windows over the cooling apparatus. Nvidia has fine-tuned the cooler so extensively that it won't allow add-in board makers to modify it at all, so every Titan will look exactly the same. As of press time, we are confident that only Asus and EVGA will be offering the Titan, as they were the only companies to offer the GTX 690.

GPU BOOST 2.0

This time around, Nvidia has a new take on how the card's clock speed boosts during gaming, and it's designed to make acoustics the top priority. For the first time ever on an Nvidia GPU, you can use the add-in board manufacturer's software to set the board's maximum temperature and you can increase the voltage, as well. You can also adjust clock and fan speeds like you have in the past, but the temperature control is what makes the card unique. By default, the card will automatically boost its clock speeds as



The Titan gets all-new (and exclusive) software tools that let you prioritize clock speeds or GPU temperatures, and Nvidia is letting end users over-volt the card, as well.

long as it's below a preset temperature threshold, which is 80 C out of the box but can be nudged as high as 95 C via software. The way this works in the real world is that you can tweak the card's temperature and fan speed to achieve a combination of overclocked and loud, or stock speeds and quiet, or anything in between, and, yes, the card can run totally silently even while at 100 percent load. Though we haven't tested overclocking as of this writing, we did see an Nvidia-run demo with our own eyeballs that had the card running at 1,200MHz, and we're also told that when water-cooled, the card can run above 1GHz all the time. Finally, the Titan also lets you overclock your display, though this new feature only works on some displays, just like some CPUs overclock and others don't. It supposedly lets your frame rate exceed the refresh rate of the panel, and it works on both 60Hz and 120Hz panels, though we have not seen it in action.

TITANIC PERFORMANCE

When we first sat down with Nvidia PR to hear about the Titan, we were told it would see "eye-to-eye" with the $1,000 dual-GPU GTX 690. Now that we've tested the card, it's clear that the Titan exists in the same rarefied air as the GTX 690, but the two cards are not equals in terms of performance. The dual-GPU GTX 690 is the faster card for gaming, and the Asus Ares II HD 7990 is faster still, reinforcing the fact that two GPUs are always better than one. That said, the Titan held its own against its single-GPU competitors in the GTX 680 and the HD 7970, easily dethroning both of them to capture the title of fastest single GPU available, which comes as no surprise.

In our tests we saw the Titan hold an advantage over its GTX 680 predecessor of about 20 to 40 percent depending on the benchmark, which is a substantial improvement considering the two cards are both Kepler boards. We typically only see this kind of performance delta in generational changes, such as moving from Fermi to Kepler. Naturally, the Titan also held an advantage over the HD 7970 in terms of performance, but it's also quieter at stock speeds despite being more powerful.

AMD'S STRATEGY

No big announcements on the horizon

Just before we went to press, AMD held a conference call with journalists to reiterate its current position in the graphics market. The call was in response to a leaked slide that showed the Radeon HD 7000 series remaining "stable throughout 2013," with an arrow pointing from the present time all the way through Q3 of this year. On the call, AMD representatives told *Maximum PC* that its HD 7970 was the price-to-performance leader currently, a claim we agree is true since it performs the same or better than a GTX 680 and costs around $70–$100 less. AMD added that it would make no sense to release new hardware since its current lineup is already the best. This was before the Titan arrived, by the way, but we doubt it will change AMD's tune of "price-to-performance" leadership. We also doubt we'll see any new flagship hardware from AMD anytime soon, as it's still highly competitive with the GTX 680, and the majority of gamers actually buy the cards downstream of those products anyway. Plus, with AMD's newly announced deals to provide GPUs to PS4 and possibly the next-gen Xbox, the company might indeed just be focusing elsewhere for the time being. AMD did say it would show off new hardware in 2013, but not until later in the year.

But you already knew, or at least had a strong tingling sensation, that the Titan would trounce its single-GPU rivals. How did it do against its dual-GPU $1,000 classmates? Not so well, as we stated earlier, but the Titan has two distinct advantages over these cards. The first is its relatively svelte size, as it's merely 10.5 inches long and requires only one 8-pin and one 6-pin power connector. The GTX 690 is a half-inch longer, which might not seem like a lot until you're trying to build a system into a Mini-ITX chassis, in which case that extra half-inch makes all the difference in the world. Second, its power requirements are very modest as well, with Nvidia recommending just a 600W PSU as opposed to 650W for the GTX 690 and 850W for the AMD-based Devil 13 and Ares II dual-7970 cards.

The third advantage is that you don't have to worry about headaches resulting from dual-GPU optimizations, which we experienced in our testing. When new games or benchmarks come out, there is oftentimes a wait for drivers to get both GPUs working. It's an infuriating first-world problem to drop $1,000 on a dual-GPU card and only be able to use *one* of the GPUs with a badass new game or benchmark. For example, Crysis 3 and Catzilla both gave us issues with the dual-GPU configurations.

> IT'S AN INFURIATING FIRST-WORLD PROBLEM TO DROP $1,000 ON A DUAL-GPU CARD AND ONLY BE ABLE TO USE ONE OF THEM

TITAN VS. SLI AND CROSSFIREX

When we pitted the Titan against dual-*card* configs it also lost in every test, which is not a surprise; but then again, since Nvidia told us the Titan would stare into the eyes of a GTX 690 we thought it might stand a chance against two GTX 680s in SLI. It doesn't. So if you're reading this and staring at your lonely GTX 680 or HD 7970, the best upgrade you can make is to buy a second card for SLI/CrossFireX. That will give you performance that exceeds the Titan for a fraction of the cost. For what it's worth, we also ran dual Titans in SLI and not only did it leave us with spittle about our mouths, it also broke every benchmark record we have. Sadly, we didn't have time to run three Titans in tri-SLI but it surely would have been glorious, and it would have required a cigarette break once it was over.

In the final analysis, the Titan is one kick-ass GPU. It's easily the fastest single GPU available, by a healthy margin, so now the crown is firmly back in the Nvidia camp after resting between its own and AMD's camp for most of 2012. The Titan will mainly appeal to gamers with deep pockets who want maximum horsepower in a small chassis that can't fit a GTX 690, as well as those folks who don't want to mess with SLI ever, or those looking to run multiple displays via two or three Titans. That's a small group, which Nvidia estimates is only 1 to 2 percent of gamers. Nevertheless, for those people with these specific needs, the Titan is the end-all, be-all gaming card for now and probably the rest of 2013, unless AMD pulls a trump card out of its hat. And it better be one hell of a card, too, because it's going to take something twice as powerful as the HD 7970 to dethrone the Titan.

BENCHMARKS

	EVGA GTX Titan	Asus GTX 680 TOP	Asus Radeon HD 7970 DC2 TOP	EVGA GTX 690	Asus Ares II 2x HD 7970	PowerColor Devil 13 HD 7990
Driver	314.09	314.07	13.2	314.07	13.2	13.2
3DMark Fire Strike	8,854	6,543	4,745	9,448	**12,299**	10,535
3DMark 2011 Performance	12,811	10,921	9,253	15,195	**15,920**	14,846
Unigine Heaven 4.0 (fps)	35	24	22	39	**50**	41
Catzilla Beta	7,355	5,711	4,462	**9,837**	9,643	8,160
Crysis 3 (fps)	22	18	18	31	**42**	23
Shogun 2 (fps)	49	39	48	61	**65**	57
Far Cry 3 (fps)	39.3	30	25	48	**58**	49
Dirt 3 (fps)	100	79	73	120.3	**153**	145
Metro 2033 (fps)	26.3	17	19	29.6	**36**	32
Hitman: Absolution (fps)	43.9	26	29	47	**63**	54
Batman: Arkham City (fps)	97	66	61	**109**	100	96

Best scores are bolded. Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an Asus P9X79 motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows Ultimate. All games are run at 2560x1600 with 4X AA except for the 3DMark tests.



A MAXIMUM PC CHALLENGE

Does Refresh Rate Matter?



WE PIT A 60HZ PANEL AGAINST A 144HZ PANEL TO SEE IF HYPE OVER THE HIGHER SPEC IS WARRANTED **BY GORDON MAH UNG**

We all know how the game is played when it comes to selling tech products. Six cores are better than four, two GPUs are better than one, and 1GHz is better than 500MHz. Besides the underlying pixel technology, monitors have really only been sold on either size or resolution—until now. In the last few years, manufacturers have begun marketing panels with more than double the refresh rate of a standard LCD panel. Rather than the 60Hz refresh rate that LCDs have been stuck with since, well, forever, these new monitors push the refresh rate to 120Hz and even 144Hz. A high refresh rate promises smoother scrolling and less blur in games, but these qualities may not be for everyone.

Doubling the frame rate in *The Hobbit* from 24fps to 48fps, for example, is widely blamed for giving the movie its odd look that turned off many viewers. (While refresh rate and frame rate aren't completely synonymous, they effectively produce the same result on the PC.) Is the same true of content on a high-refresh-rate PC monitor? To find out whether people prefer the effect of a high refresh rate or the familiar 60Hz experience, we set up two identical PCs, with a 60Hz panel hooked up to one and a 144Hz panel hooked up to the other, and tasked a handful of gamers, editors, and other test subjects to pick their pixel-pushing poison.

THE TESTING METHODOLOGY

It's said that humans perceive reality at about 66 frames per second. Would watching a movie or game at more than double that hurt or help the experience?

For our tests, we built two nearly identical X79-based machines. Each was outfitted with a stock 3.6GHz Core i7-3820, 8GB of DDR3/1600, an OCZ Vertex 3 SSD, and a GeForce GTX 580 card. Each machine was loaded with a clean install of Windows 8 and the identical Nvidia drivers were installed on both. We say "nearly identical" because the motherboards in our two boxes did differ. One featured an Asus P9X79 WS and the other an Asus Sabertooth X79 motherboard.

THE CONTENDERS

Representing the high-refresh-rate camp was Asus's new 24-inch VG248QE. This is the first monitor to bring a 144Hz refresh rate to a consumer panel. The monitor is commonly found for $300 but one reputable e-tailer had the panel listed for $265. The 1920x1080 VG248QE is LED-



We used a GoPro Hero3 Black to record 720p video at 120fps for our tests.

backlit and has a rated 1ms gray-to-gray response time and features an antiglare surface. The panel supports Nvidia's 3D Vision 2 but does not ship with an emitter or 3D glasses, to keep the price low. In fact, the VG248QE is one of two high-refresh-rate monitors Asus sells without 3D emitters, to appease gamers who want higher refresh rates but don't necessarily want to play in 3D. As a gaming panel, the VG248QE also features the company's "GamePlus" feature that will display a crosshair on the screen to circumvent (ahem, *cheat*) games that forego crosshairs when set to hardcore mode. Another mode displays a game timer for MMO players doing timed raids, and RTS gamers running on a clock. The VG248QE is a TN panel, so folks with high-



It's not attractive, but by covering the bezels of both monitors, we could guard against bias.

color-accuracy needs should probably pass it up for IPS-like technology.

Representing the standard 60Hz field was an Asus VN247. We considered pitting the 144Hz panel against a 60Hz IPS panel, since the prices are similar, but in the end we decided that gamers would be more interested in TN, given that tech's faster response time. The VN247 measures 24 inches and also features antiglare coating. It has a 1ms gray-to-gray response time and is rated at 250 nits. The 144Hz-rated VG248QE has a 350 nit rating, so we adjusted the brightness accordingly. Both were set to their "theater" preset, which we found to be fairly comparable upon visual inspection.

Since even the bezel of a monitor can influence people during image-quality tests, we used cardboard to cover both bezels of the panels, as well as the PCs themselves (since we used different cases for each). We also used identical keyboards, mice, and mouse pads for each machine, and audio was disabled on both, since, as we know, a monitor with better sound can be perceived as "looking" better.

THE TESTS

For our tests, we used three videos: The first was a 720p resolution video of an editor's commute across the Bay Bridge, shot at 120fps with a GoPro Hero3 Black. The second video was a FRAPS-recorded session of Left 4 Dead 2 running on a different 120Hz panel with VSync enabled, which locked the video down to 120fps. The third video was a 1080p high-definition MKV file at 24fps. This movie should have no bearing, as its way below the refresh rates of both panels, but we wanted to see how our test subjects would react to it. We believed the videos would be the most difficult part of our test, but we wanted to see what people's eyes preferred.

For gaming, we used two Source Engine titles: Left 4 Dead 2 and Portal 2. We decided on them because they would comfortably exceed the refresh rate of both panels with the GeForce GTX 580 GPU in our systems.

For our final two tests, we asked the test subjects to scroll a web page as they would in real life and to move a window around the screen in their typical fashion.

THE INSTRUCTIONS

All of our test subjects were given the same instructions to weigh the smoothness of each monitor first and foremost. Subjects were also instructed to try to ignore color saturation, black levels, contrast, or color



We wanted to know whether scrolling a web page looks better at 144Hz.

temperature when picking the experience they preferred. The tester was careful not to suggest one panel over the other or to make approving or disapproving statements. Finally, all of the testing was conducted in a sealed and darkened room, away from prying ears and eyes.

THE SURPRISING RESULTS

Our staff overwhelmingly preferred the 144Hz panel but our test subjects didn't always agree

Before we get too far, we'll say that our preference is for the 144Hz or 120Hz panels. The overall smoothness, although unfamiliar at first, is something we quickly got used to. If we had to choose between a 60Hz TN panel and a 120/144Hz panel, the choice would be easy. The actual blind-test subjects, however, didn't see things quite as cut-and-dried.

THE CONSOLE GAMER

Our first test subject is a software and hardware reviewer at a major console games magazine. As we expected, the video portion of our test was the most challenging and our subject had no preference in either of the high-frame-rate videos, but she preferred the 60Hz panel for the 24fps material.

As we moved onto gaming, she quickly latched onto the 144Hz panel, even saying the 60Hz panel is "tiring my eyes out," and "Owww, it's hard on my eyes." Moving on to what we thought was the easiest section, she surprised us by having no preference with the scrolling-web-page test. And in a further surprise to us, she picked the 60Hz panel in the moving-window portion because the text stayed sharper.

THE SALESMAN

The second subject is a salesman who's also a gamer and PC enthusiast. He preferred the 120fps GoPro video on the 144Hz panel, saying, "This is more realistic." He had no preference in our high-frame-rate FRAPS video, and also preferred the 24fps material on the 60Hz panel. Interestingly, the subject felt Left 4 Dead 2 "felt smoother" on the 60Hz panel but then in Portal 2 preferred the 144Hz panel. In our scrolling and window-moving tests, he preferred the 144Hz panel.

THE GEARHEAD

Our third subject is a hardware editor with a leading PC magazine. He was familiar with our challenge so we tried to throw him off by telling him we had swapped the monitor positions. He still picked the 144Hz panel for all of the tests save one: the HD source material at 24fps, which he said looked better on the 60Hz panel. Color us cynical, but we suspect some confirmation bias at play, as his picks didn't actually mesh with others.

THE TECH EDITOR

Our next subject is a long-time hardware and tech editor. He immediately picked our 120fps GoPro video on the 144Hz panel and had no preference for our FRAPS video.

THE REFRESH-RATE RESULTS

Don't blink. To find out if high refresh rates are worth it, we tasked eight people to take our blind taste test

Subject	1	2	3	4	5	6	7	8	Winner
Occupation	Console Games Editor	Salesman	Hardware Editor	Tech Editor	Games Editor	I.T. Guy	Games Editor	Video Producer / Writer	
Glasses	No	Yes	No	Yes	No	No	Bionic	Yes	
Age / Sex	31 / Female	32 / Male	34 / Male	46 / Male	23 / Male	45 / Male	38 / Male	37 / Male	
GoPro Hero3 Video 120fps	Neither	144Hz	144Hz	144Hz	144Hz	Neither	60Hz	144Hz	144Hz
Left 4 Dead 2 FRAPS Video 120fps	Neither	Neither	144Hz	Neither	60Hz	Neither	Neither	60Hz	60Hz
HD MKV Video 24fps	60Hz	60Hz	60Hz	60Hz	60Hz	Neither	60Hz	Neither	60Hz
Left 4 Dead 2	144Hz	60Hz	144Hz	Neither	60Hz	Neither	60Hz	60Hz	60Hz
Portal 2	144Hz	144Hz	144Hz	60Hz	144Hz	144Hz	144Hz	60Hz	144Hz
Scrolling Test	60Hz	144Hz	144Hz	60Hz	Neither	144Hz	Neither	144Hz	144Hz
Window Moving Test	60Hz	144Hz	144Hz	60Hz	Neither	144Hz	144Hz	144Hz	144Hz

And, like the others, picked the 60Hz panel for the 24fps HD movie.

In games, however, he had no preference in Left 4 Dead 2 and actually preferred Portal 2 on the 60Hz panel, saying, "It just looks sharper to me." He also preferred the 60Hz panel for both our scrolling test and moving-window test, echoing our first test subject's reasons: sharper text, albeit at an admittedly lower frame rate.

THE PC GAMER

Our fifth subject, a junior games editor, chose the smooth rims of the wheels in our GoPro video at 144Hz versus the strobing on the 60Hz panel, had no preference on our FRAPS video, and like all others, picked the 60Hz panel for the 24fps material.

In games, he first picked the 60Hz panel saying, "This one definitely feels smoother," but then reversed his preference in Portal 2, saying, "[The 60Hz] is definitely smoother, but I'm liking Portal 2 on [the 144Hz panel]." However, he described the differences between the two monitors in Portal 2 as "miniscule." He also picked the 60Hz panel for both the scrolling and window-movement tests, saying it was "smoother" for both.

THE IT GUY

An IT guy served as our next subject. He had no preference whatsoever in any of our video tests or when playing Left 4 Dead 2. But he thought the 144Hz panel had a slight advantage in Portal 2. In our scrolling and window-moving tests, he picked the 144Hz panel for both, saying the panel was "snappier."

GAMES EDITOR

We included a second gaming editor for his "bionic-like" LASIK-corrected eyesight. However, he bucked our expectations by choosing the 60Hz panel in both our GoPro video and in the HD movie, believing the 60Hz panel was "sharper." In our L4D2 test, he picked the 60Hz panel even though he said he thought the 144Hz panel was actually "smoother." When we got to Portal 2 though, he uttered, "uh oh" and "oh, dear," as he realized which panel was actually 144Hz, which is the one he preferred in *that* test. He said the scrolling and window-moving tests were both smoother on the 144Hz panel, but that he didn't care about those factors very much.

THE VIDEO PRODUCER

A self-proclaimed video nerd, this subject immediately keyed in on the differences between the panels. He picked the 144Hz panel for the GoPro video, calling it more "realistic" (albeit "wigging" to his eyes), but preferred the 60Hz panel for the FRAPS video and had no preference for the 24fps material. In gaming, he could tell the difference between the two monitors but actually chose the 60Hz panel because the motion blur felt more "comfortable" to his eyes. "This is like an old shoe," he said, even though intellectually he knew the other one was faster. He thought that scrolling on the 144Hz panel made it seem like the web page was on "grease" and, though off-putting, he said he thought he could get used to it. "If you said I could take one home right now, I would take the high-refresh-rate monitor."

THE UPSHOT

When we tallied up the results, it was a closer contest than we expected. Rather than 144Hz being the clear-choice technology, in many instances our subjects preferred the 60Hz "look," even if they couldn't always articulate exactly why they liked it more.

Display expert Dr. Ray Soneira said some of our results are not surprising. Video tests are particularly challenging when you're trying to display video at frame rates that don't divide into the refresh rate of the monitor. This creates artifacts that hurt the experience. More puzzling to us is why the 144Hz panel was the preference with Portal 2 but not with Left 4 Dead 2 (which is based on the same game engine). One theory is that L4D2 takes on a too-smooth, "plastic-y" look (more so than Portal 2) when seen at high refresh rates, and that puts people off.

Still, we're going to call this a win for 144Hz—but only by a hair. Our testing shows that it's certainly not the clear-cut, no-doubt-about-it choice for everyone.

THE SKY'S THE LIMIT

Or why Asus says we may actually see higher-than-144Hz panels

Despite the somewhat mixed results in our blind taste test, it's pretty clear to *us* that higher-refresh-rate panels offer a real advantage for gamers. We spoke with Asus's David Wung to get the skinny on high-refresh-rate monitors.

Q: WHAT IS THE LIMITATION IN GETTING 120HZ/144HZ REFRESH RATES IN IPS/PVA PANELS RATHER THAN TN?

A: Two main factors affect whether the panel can support 120Hz/144Hz—ignoring the scaler requirements and other issues. The first is the timing controller, or T-Con for short. It's the IC package that controls the timing frequency transmitted to the panel. The second is the graphics card supporting the proper timing for 120Hz/144Hz operation, which is no longer a problem [so there's really no reason the technology won't be found in other panel types].

Q: WHY IS ASUS THE SOLE PRODUCER OF 144HZ PANELS TODAY?

A: The primary reason is that Asus has a very close professional relationship with the leading panel suppliers and graphics card vendors. At times, we often receive exclusive collaboration from our partners due to our ability to engineer, produce, and market these premium products in volume. Our LCD team also works extensively with our in-house VGA team, which guarantees that the 144Hz panels work seamlessly with a variety of GPU products.

Q: ARE PEOPLE BUYING THESE MONITORS PRIMARILY FOR GAMING?

A: It depends, but most of time, we think so. In some cases, people also can sense the benefit while watching video on a panel with 144Hz support. We have noticed an incredible rise in popularity of the 120Hz, and now 144Hz panels, in gaming over the past two years, but now we are also seeing a similar rise in other environments like media playback and digital content creation, since the higher refresh rates allow a smoother overall image display.

Q: WHAT EXACTLY IS THE SPECIAL SAUCE IN MAKING 120/144HZ PANELS? IS IT ONLY CHERRY-PICKED PANELS THAT CAN HIT THE SPEEDS?

A: Not at all. Unlike with CPUs, as long as we can successfully develop the T-Con [monitor timing controller] and can get the support from graphic cards, then the panels can hit the speeds we need them to hit.

iFixit presents:

AUTOPSY

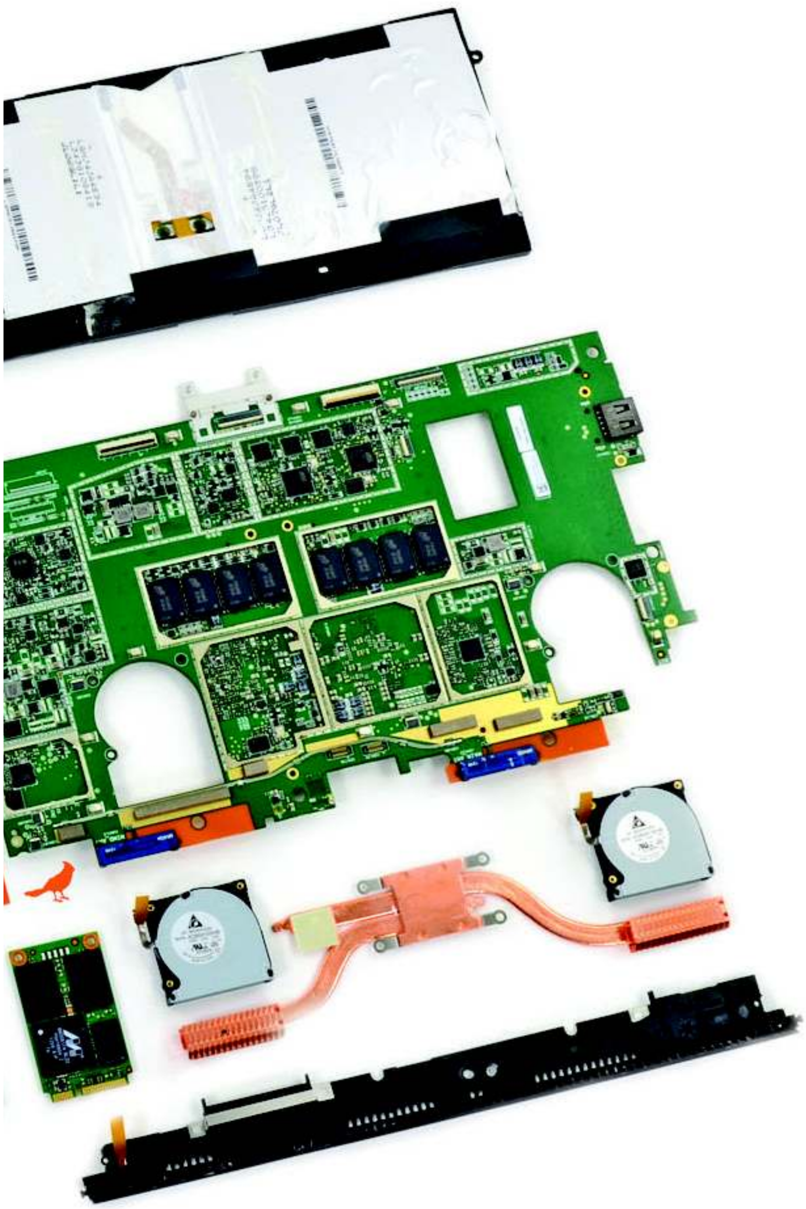
THIS MONTH WE DISSECT...

Microsoft Surface Pro



About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.



BACKGROUND:

Microsoft's x86-based Surface Pro is capable of supporting any software you'd run on a desktop PC. Unfortunately, it's not nearly as accommodating when it comes to repairs.

MAJOR TECH SPECS:

• Windows 8, the real deal
• 10.6-inch ClearType HD Display (resolution of 1920x1080 pixels) with 10-point multitouch
• Third-gen Intel Core i5 processor with Intel HD Graphics 4000 (the same graphics found in current-generation MacBook Pro laptops)
• 4GB of DDR3/1600 RAM
• 64GB or 128GB flash storage
• Wi-Fi (802.11a/b/g/n) and Bluetooth 4.0

KEY FINDINGS:

• A ridiculous amount of adhesive holds the screen in place, making accessing the insides tricky. Luckily, we had the required heat gun and guitar picks ready.

• Strapped to the back of the LCD is a small PCB, housing a Wacom W9002 chip that we assume is responsible for driving the Wacom Electro Magnetic Resonance (EMR) digitizer system.

• After removing numerous screws and employing the help of a spudger, we extracted the motherboard assembly and SSD.

• The Micron RealSSD C400 packs 64GB of storage capacity in a tiny 1.8-inch form factor.

• The top of the motherboard features 8x Micron 2LEI2 D9PXV 4Gb chips for a total of 4GB RAM, as well as a couple of touchscreen controllers and a Realtek ALC3230 audio codec. The bottom of the mobo features the Intel Mobile HM77 Express chipset and a Core i5-3317U processor, among various other chips.

• Two small fans help keep the Pro cool, and the plastic top-rear bezel doubles as a vent for the Pro's laptop-worthy hardware.

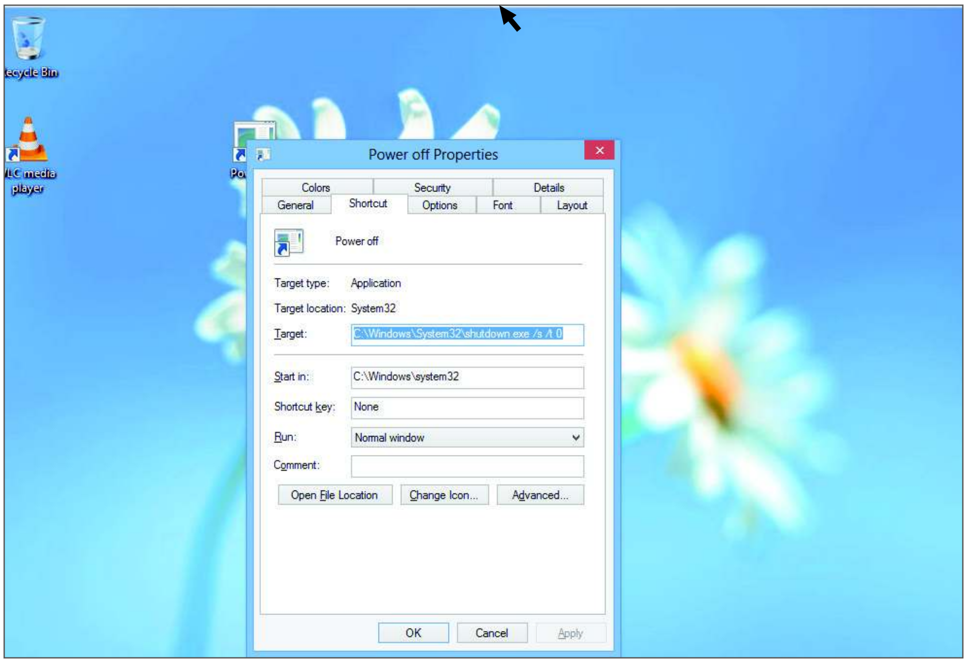
• Microsoft sourced the Cadillac of batteries from LG: an Escalade 42 Wh unit. The battery is rated for 7.4V and 5676mAh. It's not soldered to the motherboard, so at least no soldering is required to replace it.

• Repairability score: 1 out of 10. There are *more than 90 screws* inside this device. The display assembly is extremely difficult to remove/replace. Tons of adhesive holds everything in place, including the display and battery. Unless you perform the opening procedure 100 percent correctly, chances are you'll shear one of the four cables surrounding the display perimeter.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

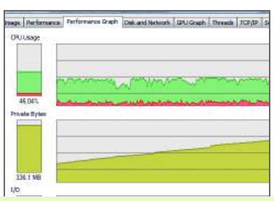
WINDOWS TIP OF THE MONTH



MORE CONVENIENT SHUTDOWN IN WINDOWS 8

Microsoft seems to have gone out of its way to hide the shutdown button in Windows 8—you have to go to the Charms bar, then click Settings, then Power to find it. To make it easier to power down your PC, create a shortcut for the command: "shutdown /s /t 0" and pin it to the Start screen.

MAKE - USE - CREATE







ALEX CASTLE
CONTRIBUTING EDITOR

THE CASE FOR WINDOWS 8

OVER THE LAST few weeks, I found myself in several conversations with friends who—despite never having tried it—had a very negative opinion of Windows 8. However, after showing one of the aforementioned friends some hardware running Windows 8, she was quite taken with it. If you find yourself trying to make the case for Windows 8, here are a few things that can help:

- **Show it off on touch hardware** The Start screen just makes so much more sense on a touch interface. If you don't have one, go down to Best Buy or somewhere else that does—it's that important.
- **Don't let them gloss over the Start screen** Everyone's heard bad things about the new Start screen, but it's actually got some really cool features. Make sure they take some time to play with it.
- **Don't install a replacement Start button** The easiest way to learn the new Start screen is to actually use it, and you won't if you've brought back the old Start button.

↘ submit your How To project idea to: comments@maximumpc.com

Investigate System Hang-Ups with Process Explorer

YOU'LL NEED THIS

PROCESS EXPLORER A more powerful alternative to the standard Task Manager, Process Explorer is available for free at http://bit.ly/G1ydL.

ALL MY APPLICATIONS are closed, so why is my PC's fan suddenly blowing like an asthmatic elephant? Something is driving the processor hard, but what could it be? Have my antivirus defenses been breached? How do I find out what's going on?

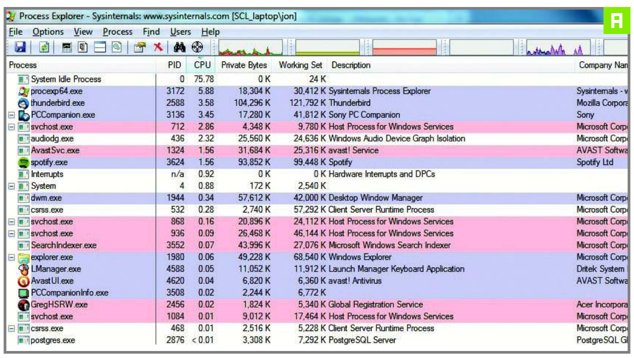
Deep at the heart of Windows lies the system scheduler. Easily the most complex and busy part of the operating system, this lump of impenetrable code controls access to system resources. It's the best place to see what's happening and whether it's legitimate. For serious investigation, though, the built-in Task Manager isn't enough. We need something with more precision and scope.

We need the free Process Explorer tool by Mark Russinovich. This Microsoft-supported stand-alone program is exactly what we want to delve safely into the heart of the operating system. –JON THOMPSON

1 GET STARTED The first step is to get Process Explorer, which you can find at http://bit.ly/G1ydL. It doesn't need installing, so once you've downloaded it, you can easily carry it with you on a USB stick to diagnose problems on other people's PCs. Click Download and a zip file opens. Create a folder somewhere convenient and drag the rocexp.exe file into it.

» To get a good look at the system scheduler, we need to run Process Explorer with Administrator rights. To do so, right-click the procexp.exe file and select Run as Administrator. A security pop-up will appear, asking you to confirm your decision. Click Yes and the main Process Explorer interface will appear (**image A**). Maximize the window to see the most system information.

» Click View > System Information and a window pops up showing current resource use (**image B**). There are several tabs, which give overviews of different parts of the OS and its processing hardware. On multicore systems, you should see multiple traces—one for each core.





2 INVESTIGATE PROCESSES If CPU use seems high, Process Explorer can tell you which application is hogging it. On the main screen, click CPU and the display sorts itself by the amount of CPU time taken. Processes should pop to the top of the list for a few seconds each. If a process stays at the top, this indicates high CPU use.

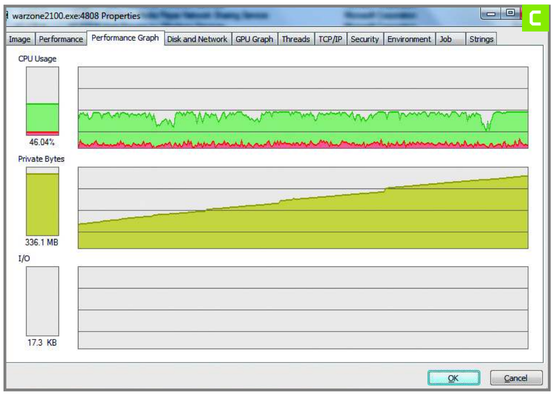
» Click the Process heading to see which processes are running. Scroll to the bottom of the display to see those started under Explorer—highlighted in pale blue. These are the applications you're currently using, and the background processes that are started when you log in.

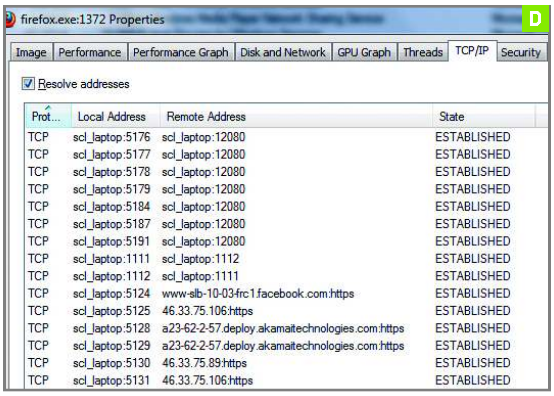
» Right-click a running process and select Properties. This brings up a window containing a detailed view of the process, split into several tabs. The performance graph (**image C**) is great for telling you if the process is taking too many resources and whether that use is increasing. Steadily mounting memory use might be a sign of memory leakage (taking memory, but not giving it back when finished with it).

» Process Explorer has a handy way of identifying a running process. First, bring the application in question to the front of your desktop. Next, in Process Explorer, drag the target icon at the top of the interface onto the application in question. This temporarily minimizes Process Explorer and displays the application you selected. Drop the icon over the application and its process will be selected in Process Explorer.

» When a new process begins, it can be hard to spot it in Process Explorer's list. To make new processes easier to find, click View > Scroll to New Processes. When a new process begins, the display will then scroll to it and highlight it for you in green. Uncheck the option to switch off this feature when you want a more stable display.

» Some malware connects to the outside world, and we can find out which websites it's linking to. Right-click a process and select Properties. On the resulting window, click the TCP/IP tab (**image D**). Ensure that the "Resolve addresses" button is ticked and expand the headings to see the websites being connected to. Do they look dodgy? If so, it could be time for a full system scan.



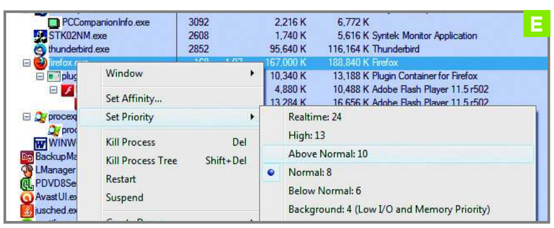


3 TWEAK, KILL, AND RESTART PROCESSES

If you have a game or another demanding application running, you can boost its priority in the system scheduler. To do so, right-click its process and select Set Priority (**image E**). Applications are normally set to Normal, but increasing this to Above Normal will increase its availability to the CPU. Don't be tempted to set priority to Realtime or you may lock up the system!

» There's nothing worse in Windows 7 than a process that suddenly "ghosts out" and the dread words "Not responding" appear in its window title. Instead of simply killing it or waiting for it to die, you can try restarting the process. To do so, find it in Process Explorer, then right-click it and select Restart. This will tell the scheduler to free the process's resources and start again.

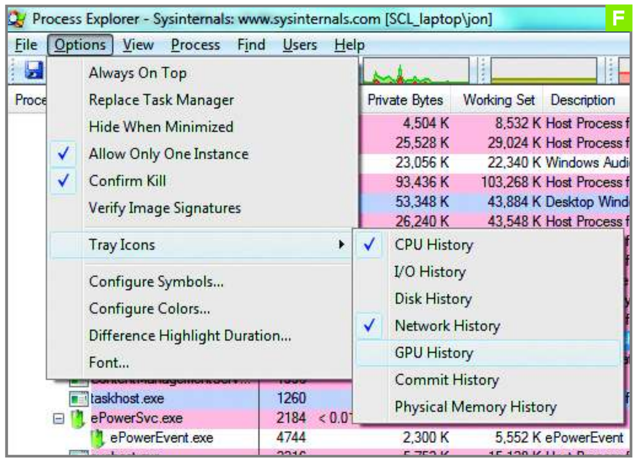
» On a multicore system, a process that uses 100 percent CPU will usually do so using only one core. The others are free to run Process Explorer, so you can still kill the offending code and free up the system to reboot it properly. Right-click the process and select Kill Process. Confirm that you want to kill it and the process will end.

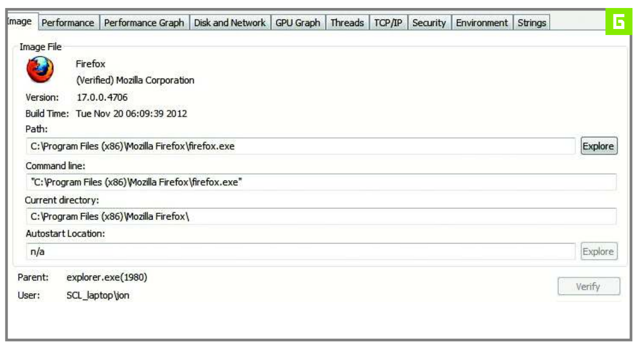


4 EXPLORE OTHER FEATURES

When Process Explorer is running, you'll see a small graph of CPU use in the system tray of the Windows taskbar. You can add other graphs here for handy reference by clicking Options > Tray Icons and selecting what you need (**image F**). Note that these only appear when Process Explorer is running. If you hover the mouse over a graph, you'll be presented with more details.

» Having delved into your running operating system, it's very useful to make sure that nothing has tampered with an application's code. To do so, right-click the application and select Properties. In the Image tab (**image G**), click the Verify button. If the producer is available, this will compare the .exe with a check code and the word Verified will appear next to the vendor's name.





Get Started with Screencasting

YOU'LL NEED THIS

CAMSTUDIO
A screencasting application, free at http://camstudio.org.

WINDOWS MOVIE MAKER
Microsoft's basic video-editing software, free at http://bit.ly/GUE3tv.

AVIDEMUX
A video editor with advanced features, free at http://bit.ly/Tdyv.

SCREENCASTING is simply the process of recording what's happening on your desktop, talking over it, and sticking it up on a video-sharing website. It's actually a very useful thing to be able to do, particularly if you're trying to show the great unwashed masses (i.e., everyone else) how to do something in Windows. Want to show your folks how to uninstall their printer drivers, install virus protection, or some other bit of advice? Send them a link to a YouTube video and you're done.

Screencasting is also really useful for recording games that don't use DirectX, such as Magic the Gathering Online. There's a small community of players that record their drafting experiences and share them with the world over at www.draftmagic.com, and by following this guide you could potentially join them—as long as you've got something to add, of course.

There are plenty of commercial programs that will record your desktop, but our goal here is to do it using free software. Partly because we're cheapskates, but also because it seems silly to spend a small fortune on software that you might not use more than a couple of times. Here's how to start. –ALAN DEXTER

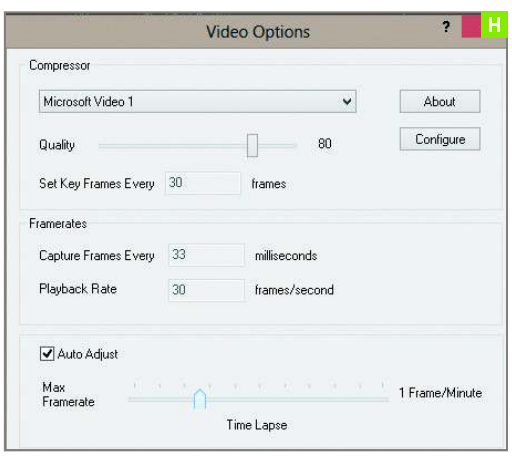
1 CONFIGURE CAMSTUDIO

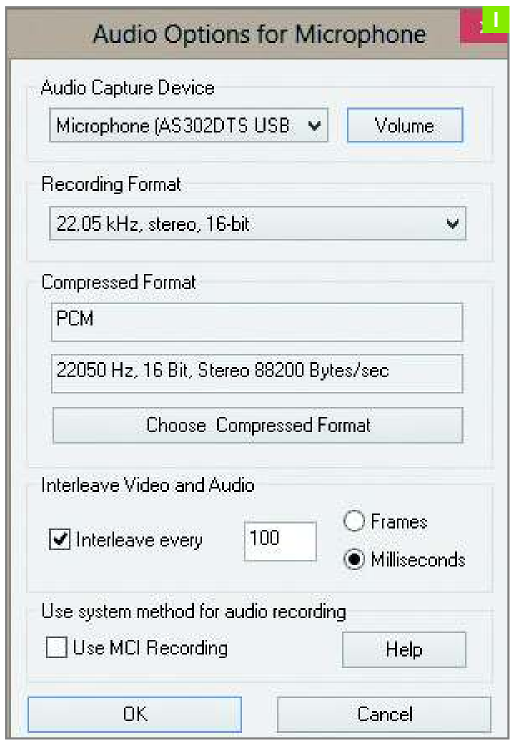
CONFIGURE CAMSTUDIO Download CamStudio Recorder from http://camstudio.org, then install and launch it. Before you hit that big inviting record button, configure the recording options. Select Video Options (image H), set the Compressor on Microsoft Video to 1, and leave the rest of the options untouched—unless you don't need smooth video (for a training video, for instance), in which case use the slider at the bottom.

» Next, configure your audio. You'll find settings under the same Options menu. Select the source that you'll be using—usually the Microphone settings—and set the volume if you can (image I). You may need to set this using the Windows utility if this doesn't work. We'd suggest running a quick sound test to make sure the audio isn't too quiet.

» Go to the Options menu again, look under the Program Options entry, and make sure "Save settings on exit" is highlighted. Next, check the option "Do not play AVI file when the recording stops," select your own directory for recording your videos, and opt for the program to ask you for a file name under the Name of AVI file option.

» Finally, make sure the Region option is set to Full Screen (we'll show you how to crop in on specifics later) and that the Automatically Stop Recording option is turned off. You're now ready to start capturing your screen. Be warned, the resultant videos can get huge very quickly—you're looking at 1GB for seven minutes on a 1080p screen.





2 PERFORM BASIC EDITING

PERFORM BASIC EDITING One tip we'd suggest is that you allow time to breathe before you start recording—a pause that can easily be removed at the editing stage. So, hit the record button, get your windows in the right places, make sure everything is good to go, and then start your narration and actions. Do the same at the end, as well.

» The next stage is to pull your movie into Windows Movie Maker (available for free at http://bit.ly/GUE3tv if you don't already have it) for basic conversion and cropping of any fluff at the start and end of your recording (image J). Begin the pro-

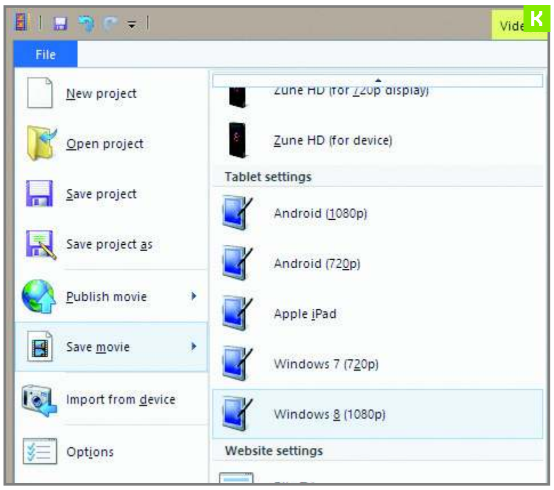
cess by locating where you want your recording to start (that is, after you've hidden the CamStudio Recorder). Be mindful of when your audio starts, as well.

» You can use the fine-step keyboard shortcuts of "J" and "L" to step through your recording to find the start point. Once there, click the Edit tab and hit the Set Start Point button. Repeat the process for the end—this might just be cutting out the bit where you stop CamStudio recording, but it's worth doing this right.

» Once you've cropped your video, you should save it in a more storage-friendly format. Select Save Movie from the File menu and pick Windows 7 (1080p) or (720p) depending on the resolution of your screen (**image K**). Save it somewhere sensible, and make sure the file type is set to MPEG-4/H.264 Video File and not Windows Media Video File.

» The actual conversion can take a little while to complete, but once finished you should find that the movie is roughly a tenth the size of the original. Play it back to make sure you haven't lost any information or introduced any oddities. If you have, just go back to the original file and be a little more careful in the cutting.





3 DO ADVANCED EDITING

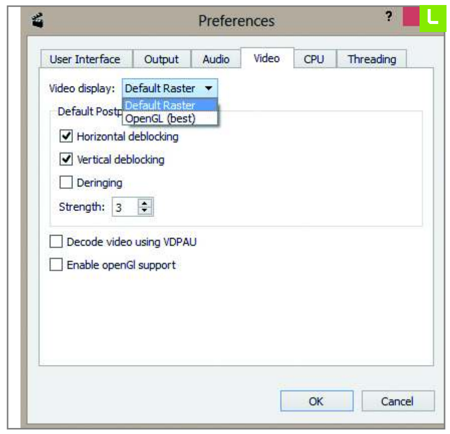
The main reason we passed the video through Movie Maker is to deal with format incompatibilities in Avidemux. However, if you want to do more than simply cut off the beginning and end of your movie, it's worth working with Avidemux's idiosyncrasies. Install the program from http://fixounet.free.fr/avidemux, then run it, drag your movie into the editing area, and hit Play to make sure all is well.

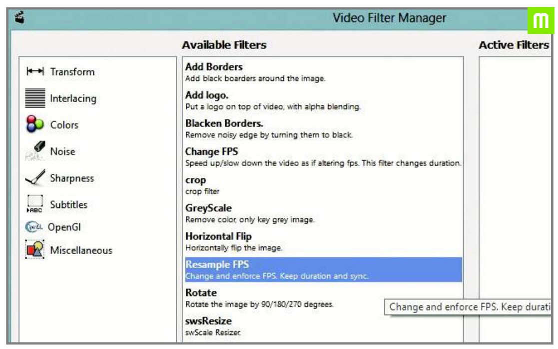
» If Avidemux crashes when you try playing your video, go into the Preferences screen from the Edit menu and select Default Raster for the Video display method under the Video tab (**image L**). This is a known issue, but easily remedied. Restart Avidemux, open your video, and hit Play—it should now play without issue.

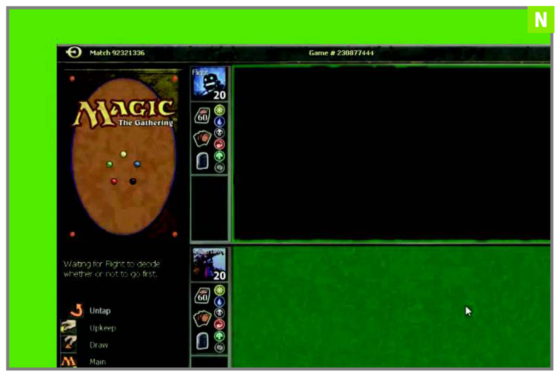
» One of the best features offered by Avidemux is its support for filters. These filters provide different ways of changing your video—from cropping in on certain areas to removing noise to swapping colors to adding subtitles. Open the Filters screen (**image M**) from the Video menu and highlight the Transform group on the left-hand panel.

» In our movie, we have a lot of excess space around the main window we're talking about, so we simply crop it out. Just enter values in the left, right, top, and bottom boxes—the area that's cropped out will be colored green (**image N**). You can drag the timeline just above the video image to make sure you've got it right.

» Set the format for your video under the Video Output option to MPEG-4 AVC (x264) and configure the Encoding Mode to be Average Bitrate (Two Pass). Set the Output to MP3 (lame) and then hit the Save Video button to create your edited, cropped film. Finally, log onto YouTube, upload the video, and bask in the fame and adulation.







BUILD IT

TOM MCNAMARA **ASSOCIATE EDITOR**



Play Crysis 3 on a Budget

We attempt to build the best PC for Crysis 3 without suffering a financial crisis

LENGTH OF TIME: **2 HOURS** | LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION When the original Crysis dropped six years ago, it quickly became the gold standard for visual splendor—and enthusiast agony. Gamers the world over fired up the demo, only to find their previously potent GPU coughing and sputtering. Thus began The Great Upgrade Rush of 2007, as we all upgraded just to play Crysis, and the game became the benchmark for PC gaming for years to come. Whenever a new GPU arrived, the first question on everyone's mind was, "Will it run Crysis?" When Crysis 2 came along it was a console port, and somewhat scaled-back technologically. The environments were small by PC standards, and developer Crytek didn't expose advanced settings for us to mess with. With Crysis 3, though, Crytek has claimed it would make your PC its bitch, and we must say after benchmarking it that we agree; bitches will be made.

So, for this month's Build It, we set out to tame the beast by putting together a bang-for-the-buck Crysis 3 machine, settling the question of whether or not you need a $500 video card or CPU to run the game at 40-plus frames per second at 1080p. It sounds like a tall order, but we'll talk you through the build, explain all the choices we made, and what mistakes we almost made.



The rugged C70 case makes our Crysis 3 system look battle-ready.

LET'S GET SORTED

AT MAXIMUM PC, we get a steady trickle of $5,000-plus systems that would handle Crysis 3 just fine. But we won't be using any of them for this project since it would be cheating. It would also be easy to go with a Core i5-3570K system, stuffed into a Z77 motherboard. That would perform well out-of-the-box, and the CPU is overclockable. There's just one problem: Intel's next generation of desktop CPUs, code-named Haswell, are coming out this summer, which means that Z77 is kind of a dead end for enthusiasts at this point. Sure, it would last us a few years but our upgrade options would be slim. Or we could go with an AMD build. Its FX CPUs look impressive on paper, but they have consistently fallen short of a 3570K in most of our benchmarks.

The answer then, both for performance and longevity, appears to be X79, aka Socket LGA 2011. It takes the smokin'-fast Sandy Bridge-E CPUs (*and* Ivy Bridge-E CPUs, expected in late 2013). It also provides enough PCIe lanes to handle multiple GPUs without a bottleneck. With our socket chosen, we settled on the "entry-level" Core i7-3820 CPU for less than $300. We wanted Gigabyte's GA-X79-UD3 mobo, for its combo of price, features, and build quality, but it was in short supply, so we tapped its big brother, the GA-X79-UP4, to act as a stunt double.

For the GPU, we picked an MSI GeForce GTX 670 Power Edition for its balance of performance, price, quiet operation, and features. AMD didn't have quite what we wanted for this build. We chose the Corsair Vengeance C70 for a case, and Cooler Master provided a snazzy Silent Pro M2 720w power supply. We loaded our OS and game files onto a Corsair Neutron GTX SSD, and cooled our CPU with an old standby after abandoning a more ambitious cooling plan.

INGREDIENTS

	PART	URL	PRICE
Case	Corsair Vengeance C70	www.corsair.com	**$120**
PSU	Cooler Master Silent Pro M2 RS720	www.coolermaster.com	**$120**
Mobo	Gigabyte GA-X79-UP4	www.gigabyte.com	**$250**
CPU	Intel Core i7-3820	www.intel.com	**$290**
Cooler	Cooler Master Hyper 212 Evo	www.coolermaster.com	**$30**
GPU	MSI GTX 670 PE	www.msi.com	**$375**
RAM	Corsair 4x 2GB Vengeance	www.corsair.com	**$50**
SSD	Corsair Neutron GTX 240GB	www.corsair.com	**$210**
HDD	Seagate 1TB Barracuda	www.seagate.com	**$70**
OS	MS Windows 7 64-bit OEM	www.microsoft.com	**$100**
Total			**$1,615**

1

THE X FACTOR

THE X79'S I7-3820 is an ideal choice because it has more features than the i7-3770K for about the same price. For example, the latter's Z77 chipset doesn't support more than 16 PCIe 3.0 lanes, while X79 chipset can handle up to 40 PCIe lanes. That gives us enough headroom to add a second GPU without hitting a ceiling. As for AMD, we considered the FX-8350 for its eight unlocked cores and 4GHz stock clocks. But in testing, it's just not as fast as the Core i7s, and its 990FX chipset doesn't support PCIe 3.0, which has twice the bandwidth of PCIe 2.0. Admittedly, the lane thing is irrelevant for a single GPU. A Z77 or 990FX board will have plenty of room for every modern GPU, but we prefer an expandable system.



2

CASING THE JOINT

WE GAVE Corsair's Vengeance C70 a good review a few months back (8 Verdict, September 2012), so we decided to give it a shot for our Crysis box. The NZXT Phantom 410 was also considered, but we needed to move this case around the office a few times, and the C70's all-metal housing and built-in carrying handles were better suited to the task. Plus, the side panels are latched, so we didn't have to worry about losing thumbscrews. It's also perfectly suitable for our build , with its modest cost and military aesthetic. It's blessed with large fan mounts, quiet stock fans, and lots of airflow, so it should help us with overclocking. We also like that both drive cages can be removed, giving our intake fans an unobstructed path to the parts that need to chill. By default, the two front fans are mounted on the cages. We moved those into the front bezel and removed the top cage. The bezel also has cutouts to feed the fan wiring back inside the cage. We left the bottom cage in place because it was easier to manage the SSD and HDD that way.



3 THE JUICE IS LOOSE

COOLER MASTER'S Silent Pro PSUs are known for running quietly and reliably, so we wanted to try one for this build. The RS720 model we used is the sequel to the original, and has the same great features, including a 135mm fan that dynamically adjusts its speed according to conditions instead of running full-blast all the time. We also like its flat cables, which are more flexible than standard rounded cables. Otherwise, it offers the same high-quality specs, plus four PCIe connectors instead of two, making it easier to run dual GPUs when Crysis 4 arrives. The flat cables made for an easier build, but be warned that this model still uses rounded cables for the motherboard and CPU power.



4 TAKING A CHILL PILL

ONE DOWNSIDE of having a motherboard that supports quad-SLI is there is very little space between the first PCIe slot and the CPU socket. In fact, we discovered while building this rig that we were unable to use a CPU heatsink bigger than 120mm, which torpedoed our plans to use an NZXT Havik 140 cooler. The Havik 140 is a massive cooler with dual fans in a push-pull config, so we figured it would let us overclock to our heart's content and stay quiet about it. But in practice, it was just too damned big. Sure, we could have installed the Havik, but it would have meant rotating the heatsink 90 degrees, which means that its fans would have been sucking air straight off a sweltering GPU, instead of the cooler air entering the case from the front intake—not a great idea. Undaunted, we decided to use our favorite low-cost CPU cooler, the always-popular Hyper 212 Evo from Cooler Master. It's not sexy but it gets the job done and is quiet, sort of like an intern.



5 THE GPU WAR

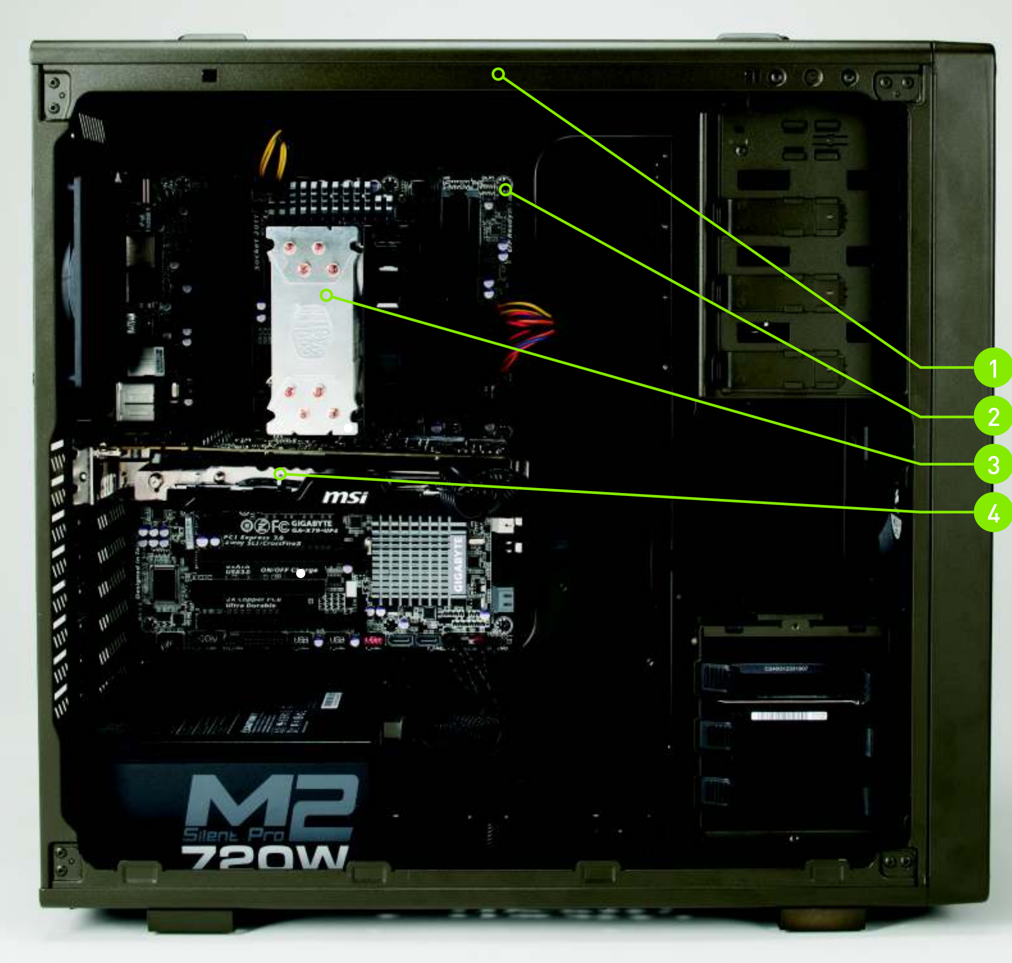
MSI KIND OF nailed it with its GeForce GTX 670 Power Edition. Its core clock is bumped up from 915MHz on the stock card to 1,020MHz, which is a slightly higher clock than that of a GTX 680, though the memory clock is left alone. Its boost clock speed of 1,080MHz is also higher than the GTX 680, which lets it keep pace with its big brother despite costing about $100 less. Its proprietary "Twin Frozr IV" cooler has dual fans and a huge heatsink with copper pipes, and it let us overclock the board even further to 1,100MHz core and 1,700MHz for the memory. We could have gone with a Radeon HD 7970, but most of them are voltage-locked and noisy. The GTX 670 Power Edition, meanwhile, is fully tweakable, and we know from past testing that this card will not give us any troubles since it's always been quiet and reliable. So, there's a low potential for frustration, a high potential for performance, and a lack of excessive noise and heat. And since we're playing at 1080p, the HD 7970's additional gigabyte of VRAM and wider data bus aren't significant enough factors to bring us to team Red this time around.



6 GOING FOR A DRIVE

AN SSD IS not the cheapest choice for storage, but when you can turn on your computer and be in the desktop in less than 20 seconds (as opposed to just staring at a boot screen while your HDD thrashes around), it's kind of a big deal. Of the current generation of drives, we have the OCZ Vector and Samsung 840 Pro alone at the top, and they cost a pretty penny at around $250–$275 for the 256GB versions. Corsair's Neutron GTX, though, hovers around $200 for the 256GB drive, despite offering nearly the same performance as the class leaders as well as the same 5-year warranty. It's our opinion that once you get to these speeds, you simply won't feel a subjective difference between the top-tier SSDs and the second tier, so why not save a little money? As a bonus, the Corsair's C70 case features slide-out drive trays with mounts for SSDs, so we didn't even need any 3.5-inch conversion kits.





1. Dual 140mm fan mounts at the top of the case can easily accommodate an extra-long radiator to cool the CPU, and that would give the GPU a little breathing room, too.

2. Gigabyte's UP4 motherboard has enough fan headers to accommodate all four fans in this system, plus room for one more. This is actually common for X79 boards.

3. The PCIe slot's proximity to the CPU socket makes extra-large CPU coolers a no-go unless you rotate them, but then their intake fan would pull hot air right off the GPU.

4. In anticipation of someday taking this rig to a dual-GPU setup, we mounted our GTX 670 in the first slot.

IT'S ALL OVER EXCEPT FOR THE CRYSISING

PERHAPS WE over-prepared. Our plan was to maintain over 40fps in Crysis 3 using the game's "High" graphics setting. As it turns out, we nearly hit that mark on "Very High" without even needing to overclock, though we were using 4x SMAA instead of 4x MSAA. The latter did not seem to have an improvement in visual quality that would justify the loss of about 5fps. The machine was also whisper-quiet throughout our testing. You could hear the 670's fans crank up a little, but it wasn't distracting, even when pushed to 1,100MHz core clock (nearly 200MHz above the reference board clock). However, if we were running a 2560x1600 display, the GTX 670 would not cut it. We'd have to get a second GPU for SLI action, as there's simply no way a single GPU other than a GTX Titan could run this game at high settings at that resolution.

Otherwise, the system was a pleasure to build and test. The C70 chassis was roomy, cool, and quiet, though the thumbscrews on the PCI slot covers required a screwdriver to loosen, which kind of defeats the point. Having the intake fans on the drive cages instead of flush against the chassis also doesn't make a lot of sense since they are set back from the front of the case by several inches. But moving those two 120mm units into the front bezel was fairly painless.

We'd like to point out that the Hyper 212 Evo CPU cooler let us take our Core i7 CPU from 3.6GHz to an overclocked 4.25GHz without breaking a sweat or making a peep, despite using just a single 120mm fan. Stock temps were around 30 C idle, with temps dipping into the mid-50s under load. The GPU hovered around 70 C when overclocked—not bad for a core clock running 17 percent faster than stock speed. MSI's copper heat pipes and dual fans helped there, for sure.

Overall, we rate this system a success both in terms of performance gained and money spent. And unlike most of our lab experiments, we *do* recommend you try this at home. A gaming system with these specs will last you at least until Crysis 4 comes out, when we'll do this all over again.

BENCHMARKS

	Stock Speeds	Overclocked	Percent Difference
Crysis 3, "Very High" (fps)	38	42	+10%
Catzilla, 1080p	8,529	9,257	+8%
3DMark 11 Extreme	3,280	3,449	+5%
3DMark 11 Performance	9,204	9,702	+5%
3DMark (2013) Extreme	3,035	3,298	+8%

REVIEWS

TESTED. REVIEWED. VERDICTIZED.



INSIDE

DIGITAL STORM BOLT TITAN PAGE 72



Next-gen this, console fanboys!

Digital Storm Bolt Titan

Dual-card-like without two cards

WE KNOW CONSOLE fanboys have already started calling the PS4 a "truly next-gen" product while saying the PC isn't one, so we thought we'd rub this in their faces: Digital Storm's Bolt Titan.

Yeah, fanboys, eat the hot pixels being thrown your way by the world's fastest single-GPU video card! It's not just any video card, either. As the DStorm's name suggests, this PC is running Nvidia's new GeForce GTX Titan. For petite systems like these, the magic of Titan isn't just its straight-line speed—it's that, as powerful as it is, the card has a relatively small footprint.

That translates into a mini-tower machine that, for the first time, doesn't give up much quarter to the dual-card setups. It's not quite the equal of a full-tilt GeForce GTX 690 card or the more exotic dual–Radeon HD 7990s, but it's a lot better behaved.

New to Titan is the ability to tune the GPU by setting thermal and performance goals. If you're running the card in your ginormous case with more fans than a Ridley Scott movie, then go to town on performance. But if you're in the Bolt Titan and gaming on your HDTV, you can tune the card until its sound is barely noticeable. The Bolt Titan favors being quiet. The box certainly isn't as quiet as Alienware's X51, with its ability to run integrated graphics via Nvidia's Optimus, nor the Falcon Northwest Tiki (reviewed in May 2012), with its liquid-cooled CPU, but it's fairly quiet during gaming bouts, especially when you consider its graphics performance. We should note that Falcon now also offers the Tiki with the Titan option.

Elsewhere in the box, there are no major differences from the GeForce GTX 680–based Bolt that we reviewed earlier this year. In fact, the original Bolt, with its Core i7-3770K clocked up at 4.4GHz, is the perfect foil for this machine. In the performance benchmarks that are mostly limited by the CPU, the 100Hz clock advantage of the Bolt Titan doesn't move the needle much, with performance roughly 2 to 3 percent faster. However, in gaming, the Bolt Titan easily knees its 680-based sibs in the nads. In Batman: Arkham City, the Bolt Titan was 62 percent faster and in 3DMark 11 we saw a 37 percent difference. Up against our Core i7-3930K–based zero-point with its GeForce GTX 690, the Bolt Titan didn't win in games, but it held its own, considering the 690 is just about the equivalent of a pair of GeForce GTX 680s in SLI. The Bolt Titan was just 4 percent slower in Batman, which is pretty much a tie, and but 16 percent off in 3DMark11. That, folks, is impressive as frak when you look at how diminutive the Bolt Titan is. We know, we know, some will say this harkens the end of the big, bad full-tower PC but, no, it doesn't.

As freaking fast as the Bolt Titan is, it's not the same as running an overclocked and liquid-cooled, hexa-core chip at speed. For example, the Geekbox Ego Maniacal that we reviewed in January, with its Core i7-3970X tuned up to 4.8GHz, hammers the quad-core chips in multithreaded CPU tests by more than 30 percent. And its quad-SLI configuration? Yeah, as fast as Titan is, a single Titan isn't going to even get within striking distance of two liquid-cooled GeForce GTX 690s. So, haters need to step off.

Still, let's not forget to pay proper homage to what Digital Storm has achieved with the Bolt Titan. It's the fastest mini-tower we've tested yet, and whether working as your HTPC gaming box or simply saving space in your office, it's hard to find much fault with this sweet little rig. –**GORDON MAH UNG**

VERDICT 9 KICK ASS!

Digital Storm Bolt Titan

+ USAIN Small; fairly quiet; freaking fast.

− HUSSEIN Can't be laid flat; case needs YouTube tutorial to close.

$2,500, www.digitalstormonline.com

BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	2,502 (-20%)
Stitch.Efx 2.0 (sec)	831	746
ProShow Producer 5.0 (sec)	1,446	1,333
x264 HD 5.0 (fps)	21.1	17.4 (-18%)
Batman: Arkham City (fps)	76.0	73.0 (-4%)
3DMark 11	5,847	4,905 (-16%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K @ 3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

SPECIFICATIONS

Processor	Intel Core i7-3770K@4.5GHz
Mobo	Asus P8Z77-I Deluxe
RAM	8GB DDR3/1600 dual-channel
Videocard	GeForce GTX Titan
Soundcard	Onboard
Storage	120GB Corsair Neutron, 1TB 7,200 HDD
Optical	Slot-fed DVD combo drive
Case/PSU	Custom / Sparkle 500W



Each Limited Edition Ares II comes in a swank briefcase and is individually numbered. We got #71 out of the total 999 made.



Asus Ares II 2x HD 7970

The fastest single-card GPU we've ever tested

JUST BEFORE the release of the GeForce GTX Titan this month, AMD held a conference call with tech media to reiterate its position in the market today, its plans going forward, and to drive home one particular point: AMD has the fastest hardware available, period. At the time of the call, we thought, "Well, that's debatable." But AMD pressed on, and further clarified its position by stating that the Asus Ares II was the fastest GPU available, bar none. Since most of us on the call hadn't seen that card, and most people never *will* since only 999 were produced, we didn't dispute the claim, nor did we have the data to know if the claim was correct. Well, about a week later, the card arrived from Asus and now that we've run the benchmarks, it looks like AMD was telling the truth—the Ares II is without a doubt the fastest single-card GPU available. So step aside, Nvidia GeForce GTX 690, there's a new sheriff in town, and it's not only faster in benchmarks, it runs cooler and quieter, to boot.

If you're surprised by this development, you probably aren't familiar with the Ares II's $1,500 price tag with specifications to match, so let's start by examining those. First, it comprises two HD 7970 GHz Edition GPUs on a single PCB in CrossFireX configuration, and the GPUs are overclocked slightly to 1,050MHz, with a 1,100MHz Boost Clock. Second, the card sports 6GB of memory that's also slightly overclocked, and it can power up to six displays at once. Third, both GPUs on the Ares II are water- *and* air-cooled. You read that right—the GPUs themselves are water-cooled via an Asetek kit with a 12cm radiator and a push-pull fan setup, and the entire PCB is wrapped in Asus Thermal Armor and cooled by an 8cm fan that sits between the GPUs.

There are only 999 of these cards in the world, and each one arrives in a combination-lock briefcase with custom foam cutouts for the card and its cooler, and a metal business-card-size "certificate of authenticity," designating which unit you're lucky to own. It's totally over-the-top and ridiculous—ridiculously badass, that is.

During testing, the Ares II demonstrated why its price tag is so exorbitant, with a display of Pure PC Power, the likes of which we haven't seen from AMD in a very long time. It crushed the former-champion GTX 690 both in benchmark performance and in noise output, which is something we *never* thought we'd say about an AMD card in relation to a Kepler card, but it's true. We *didn't hear* it with our very own ears; it was absolutely silent throughout testing and was never hotter than 63 C, even when tortured. It defeated the GTX 690 in nine out of 11 benchmarks, making it the fastest single-card GPU we've ever tested, and the quietest. Would we buy an Ares II over a GTX 690? No, the price is still too high, but everything else about this card is the very definition of Kick Ass. –JOSH NOREM

BENCHMARKS

	Asus Ares II 2x HD 7970	EVGA GTX 690	PowerColor Devil 13 HD 7990	EVGA GTX Titan
Driver	13.2	314.07	13.2	314.09
3DMark Fire Strike	**12,299**	9,448	10,535	8,854
3DMark 2011 Performance	**15,920**	15,195	14,846	12,811
Unigine Heaven 4.0 (fps)	**50**	39	41	35
Catzilla Beta	9,643	**9,837**	8,160	7,355
Crysis 3 (fps)	**42**	31	23	22
Shogun 2 (fps)	**65**	61	57	49
Far Cry 3 (fps)	**58**	48	49	39.3
Dirt 3 (fps)	**153**	120.3	145	100
Metro 2033 (fps)	**36**	29.6	32	26.3
Hitman: Absolution (fps)	**63**	47	54	43.9
Batman: Arkham City (fps)	100	**109**	96	97

Best scores are bolded. Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an Asus P9X79 motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows Ultimate. All games are run at 2560x1600 with 4X AA except for the 3DMark tests.

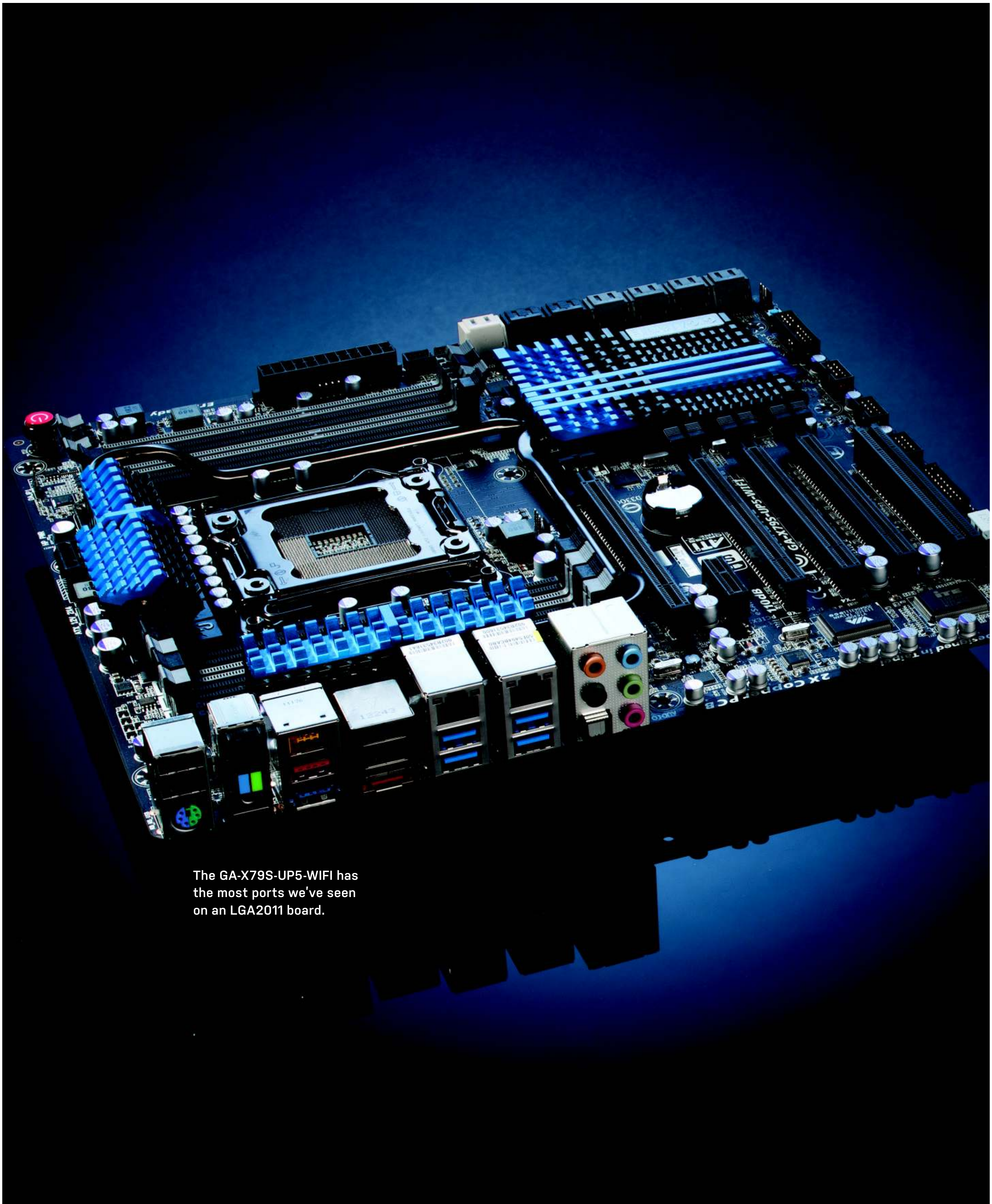
VERDICT 9 KICK ASS!

Asus Ares II 2x HD 7970

+ KRATOS Record-breaking performance; absolutely silent; runs very cool.

– ARES Requires a lot of power; super-expensive; rare.

$1,500, www.asus.com



The GA-X79S-UP5-WIFI has the most ports we've seen on an LGA2011 board.

Gigabyte GA-X79S-UP5-WIFI

Don't let the X79 moniker fool you



WHEN VENDORS previewed the first X79 motherboards in 2011, we were floored by the boatload of SATA ports. Rather than the wimpy six SATA ports (only two of which were SATA 6Gb/s) Intel chipsets usually gave us, the X79 was a he-man's chipset with a heaping serving of 12 ports.

But when we received production boards months later, the storage ports had been neutered to the same number as Z68! The reason? Incompatibility with some older SATA devices. Sigh.

That's where Gigabyte's X79S-UP5-WIFI comes in. Rather than using the X79 chipset to power this brutish board, Gigabyte picked Intel's C606 chipset (but still calls it X79 for recognition purposes). The C606 can support dual-processor motherboards (on boards with two sockets), but the main distinction is the bundled Intel SAS support. No less than 14 ports pack the front of the board. Two are SATA 6Gb/s, four are 3Gb/s, and eight are SAS, or Serial Attached SCSCI.

Before storage-freaks faint, SAS means they technically don't support optical drives. And SAS is still touchy. The manual says single disks are supported but we had issues. The 128GB Samsung 840 Pro SSD that we use for storage I/O testing would hang, but a 4TB Hitachi hard drive worked fine on SAS.

Also keep in mind that SAS support is 3Gb/s, so if you had dreams of an eight-SSD RAID 0 config rocking your world at 6Gb/s per device, you're out of luck. The Gigabyte beta BIOS we used adds the ability to push SAS speeds higher, but we ran into instability at the non-spec speeds. Remember, it's beta functionality. And disappointingly, running two OCZ Vertex 4 drives in RAID 0 on SAS gave us the same performance as the 840 Pro on SATA 6Gb/s.

If all this has you feeling let-down, there are still several pluses to the board. In performance, it hangs right there with the competition. We set up a matching configuration on an Asus X79 Sabertooth for comparison, and as expected, the performance was damned close. Close enough that we'd say performance should not be a factor in your purchase choice, based on what we saw.

In the physical layout, there are no major problems and the decision to stick with three-way SLI/CrossFireX support makes the board less cramped than those that opt for four-way GPU support. One issue for some might be the relocation of the EPS12V/ATX12V connector about four inches to the right. That could be troublesome for folks who don't have the cable length to make the run. We successfully ran the board fully loaded with both 64GB of DDR3/1333 and 32GB of DDR3/1866, alternately, with no issues. The board supports ECC RAM with Xeons, but we were unable to test it with our pedestrian Core i7 part. SLI also gave us no issues and disk and USB 3.0 I/O worked as expected. One thing to note: The default installer disc doesn't seem to like Windows 8, so you should manually load the latest files from the website.

We wish that Gigabyte would put a bit more polish on its OS utilities. Its archnemesis, Asus, seems to own the market on refined and responsive utils. The 3D Power Gigabyte tool, for example, is advanced but feels sluggish, as does the mouse control in the UEFI. Fan control on Asus boards is also far superior these days.

The final win, however, may be the price. While the very old X79 Sabertooth still fetches $360 on the street, the X79S-UP5-WIFI with its dual-band Wi-Fi 802.11a/g/n and Bluetooth 4.0 card can be had for $280. Be that as it may, we'd still probably recommend going with a regular X79 mobo because of the X79S-UP5-WIFI's oddities and the debatable value of its extra features. –**GORDON MAH UNG**

BENCHMARKS

	Gigabyte GA-X79S-UP5-WIFI	Asus X79 Sabertooth
PCMark7 overall	5,405	**5,424**
Lightweight Score	6,092	**6,213**
Productivity Score	5,154	**5,261**
Creativity Score	8,802	**8,825**
Entertainment Score	5,167	5,145
Computation Score	**8,925**	8,892
System Storage Score	5,275	**5,383**
Valve Particle Benchmark (fps)	191	192
Sandra Memory Bandwidth (GB/s)	**42.4**	40.8
3DMark Cloud Gate (overall)	**19,320**	18,970
Graphics Score	**38,287**	36,918
Physics Score	7,067	7,022
Graphics Test 1	**174.8**	168.2
Graphics Test 2	**158.8**	153.5
Physics test	22.04	22.3
SATA 6 performance (read/write)	514.6/492.3	**525.3/505.8**
RAID 0 SAS performance (read/write)	558.9/496.6	N/A
USB 3.0 Performance (read/write)	286.5/202.3	**330.3/195.4**

Best scores are bolded. Both boards were tested with a 3.6GHz Core i7-3820, 32GB of Corsair DDR3/1866 Dominator DIMMs, a GeForce GTX 580, and a 120GB OCZ Vertex 3 SSD. CrystalDiskMark benchmarks were used for storage tests. A Samsung 840 Pro was used for SATA testing, two OCZ Vertex 4 SSDs were used for RAID 0 SAS, and a USB 3.0 enclosure with Patriot Wildfire SSD was used for USB 3.0 performance.

VERDICT 8

Gigabyte X79S-UP5-WIFI

+ CLASSY Surprisingly affordable; tons of storage options.

− GASSY SAS is touchy; utilities need performance overhaul.

$309, www.gigabyte.com



The P2742 is available with a spicy orange cover, but we received a boring matte-black one.



The Fangbook features TRON-esque LEDs around the speakers, keyboard, and trackpad.

Byte vs. Bark

Two large, affordable gaming notebooks go fang-to-fang

Gaming notebooks can be quite pricey, but Gigabyte's P2742 and CyberPower's Fangbook X7-200 remind us that we don't need to break the bank to get PC gaming on the go. Not only are both of these 17.3-inch notebooks affordable at around $1,500, they also both feature the same Core i7 Ivy Bridge processor. Which one is worth your hard-earned money? Read on to find out. –JIMMY THANG

GIGABYTE P2742

While it's hard to find a 17.3-inch gaming notebook that's truly portable, the P2742's 16.2x10.9x1.9-inch chassis is relatively svelte compared to others in its size class, including CyberPower's Fangbook. With a carry weight of eight pounds, 6.1 ounces (more than two pounds lighter than our "smaller" 15.6-inch MSI GT60 zero-point), the P2742 just barely passes as a notebook you could travel with.

Although its simple, unadorned appearance might not scream gaming notebook—where are the tell-tale flashy LEDs?—its top cover features angular beveled edges that add some flare. Under the hood, the Gigabyte features a 2.4GHz Core i7-3630QM Ivy Bridge processor with a Turbo ceiling of 3.4GHz, 8GB of DDR3 RAM, and a GeForce GTX 660M with 2GB of GDDR5 memory. It also packs a 128GB SSD and a hefty 1TB HDD.

While the P2742 boasts a newer CPU than our zero-point's 2.3GHz Core i7-3610QM processor, it wasn't able to beat it in any of our CPU-intensive tests. At its best, the Gigabyte CPU was neck-and-neck with our zero-point in our x264 benchmark. GPU-side, Gigabyte's offering didn't perform any better, trailing the ZP by 13 percent in 3DMark 11 and 23 percent in our STALKER benchmark. In our experiential gameplay test, we were able to squeeze by with max settings on Dota 2 (a Source Engine game) with average frame rates in the mid-30s at 1080p. Running the more graphically intensive Far Cry 3, we had to use the default low settings to attain playable frame

BENCHMARKS

	ZERO-POINT	
Stitch.Efx 2.0 (sec)	1,092	1,100 (-0.7%)
ProShow Producer 5 (sec)	1,786	1,853 (-3.6%)
x264 HD 5.0 (fps)	12	12
STALKER: CoP (fps)	32.8	25.3 (-22.9%)
3DMark 11 Perf	2,979	2,569 (-13.8%)
Battery Life (min)	187	190

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point notebook is an MSI GT60 with a 2.3GHz Intel Core i7-3610QM, 12GB DDR3/1600, two 500GB Seagate 7,200rpm hard drives, a GeForce GTX 670M, and Windows 7 Home Premium 64-bit. STALKER: CoP tested at 1920x1080 with Ultra settings, Tessellation, and contact hardening.

SPECIFICATIONS

CPU	2.4GHz Intel Core i7-3630QM
RAM	8GB DDR3/1600
Chipset	Intel HM77
GPU	Nvidia GeForce GTX 660M 2GB GDDR5
Display	17.3-inch, 1920x1080 LED display (matte)
Storage	128GB SSD, 1TB HDD
Optical Drive	Blu-ray combo drive
Connectivity	Ethernet, VGA, HDMI, eSATA, all-in-one card reader, 2x USB 3.0, 1x USB 2.0, audio in, audio out, headphone, mic, 2MP webcam, Bluetooth, 802.11n
Lap / Carry	7 lbs, 0.6 oz / 8 lbs, 6.1 oz

rates at 1080p, which is a far cry from how great the game can look. The P2742 reminds us that the GeForce GTX 660M is no match for the GeForce GTX 670M, even if it has upgraded from Fermi to the more efficient Kepler architecture.

Above the fold is a matte 1920x1080 resolution display, which doesn't offer the widest viewing angles we've seen from a TN panel, but is perfectly serviceable. The P2742's trackpad has a coarse, almost sandpaper-like texture, which helps set it apart from the smooth surface of the palm rest. The trackpad supports Windows 8 gestures like swiping from the side and corners to bring up menus, but we found this irritating, as it often interfered with basic gestures. Luckily, disabling this feature fixed these issues, but there were still rare instances where the touchpad was unresponsive to our swipes. We had no complaints about the P2742's keyboard, which worked well whether gaming or typing.

One big issue we encountered was an error code that prevented us from installing Steam, requiring us to reformat the notebook to get it working. Gigabyte says ours was an isolated incident and that they have tested other units without such issues.

That problem aside, Gigabyte's P2742 can play the majority of games today, but it isn't as future-proof as we would like and is unable to play more graphically intensive games beyond medium-to-low settings. For $150 more, we recommend getting the much more powerful Fangbook. Still, considering its affordable price tag, spacious storage, and relative portability, there's still use for the P2742 yet.

VERDICT **7**

Gigabyte P2742

$1,400, www.gigabyte.com

CYBERPOWER FANGBOOK X7-200

While Gigabyte's P2742 is somewhat portable, the same can't be said of CyberPower's Fangbook. It uses MSI's popular bulky chassis design—the same design used by our zero-point, except in a larger 16.8x11.3x2.1-inch form factor with a 17.3-inch TN display, à la the iBuyPower CZ-17 (reviewed in January). When we asked CyberPower why this particular chassis was becoming so popular, the company pointed to its spacious design, which offers good airflow, and the fact that consumers like its aesthetic.

Even though CyberPower uses a chassis we've seen time and time again, the Fangbook does make a few tweaks. First and foremost, the cover implements a futuristic armor design, which is reminiscent of the Crysis Nanosuit. In addition, the laptop features blue LEDs peppered about the case and a red-LED-backlit keyboard. This gives the notebook a very TRON-esque vibe that asserts its gaming status loud and clear.

While the Fangbook doesn't have the most impressive specs ever, you're getting a lot for $1,550, including a 2.4GHz Core i7-3630QM CPU, 16GB of DDR3 RAM, and a GeForce GTX 675MX videocard. This is the first time we've reviewed a gaming laptop with a 675MX, which has 4GB of GDDR5 RAM and performance between a 680M and 670MX (MX cards are slightly faster than their M counterparts). While you don't get as much storage space as Gigabyte's P2742, you're still getting a 60GB Intel 520 Series SSD and a 750GB mechanical hard drive.

Thanks to these specs, the Fangbook was able to outrun our zero-point in every test. The gains weren't crazy in our CPU-intensive benchmarks (Stitch.efx, ProShow, x264)—all within 5 percent of each other—which makes sense given that the Fangbook's CPU is only 100MHz faster than the zero-point's. The performance differences were more apparent when we ran our GPU-intensive tests. The Fangbook was able to best the GT60 by 13 percent in STALKER and double-digit percentages in 3DMark 11. Clearly, the Fangbook was able to put the 670MX's extra CUDA cores, faster clocks, and additional RAM to good use. In our experiential gameplay tests, the Fangbook was able to run Dota 2 maxed out at 1080p with silky-smooth frame rates in the mid-50s. In Far Cry 3, the Fangbook was able to run at the default medium settings with frame rates in the mid-40s. We also ran the game on high, where the laptop yielded an average 30fps, though the inconsistent dips make this ill-advised.

The Fangbook's keyboard features anti-ghosting keys, which means the computer will recognize numerous button presses simultaneously. While the keyboard works well for gaming, it's not great for word processing; keypresses seemed to require more pressure than they should. We felt the same about the two buttons below the trackpad. One feature we did like is the subwoofer at the bottom for a 2.1 audio setup, which adds a little extra oomph to the auditory experience—something generally lacking in notebooks.

If you can get past the fact that the Fangbook is a heavy desktop replacement, you'll find a powerful gaming rig for an absolute steal of a price. We liked our MSI GT60 zero-point when we first reviewed it in December 2012, but the Fangbook is considerably more powerful, comes with an SSD, and offers a much larger screen for only 50 bucks more. We say it's well worth the price of admission.

VERDICT **9**

CyberPower Fangbook X7-200

$1,550, www.cyberpowerpc.com

BENCHMARKS

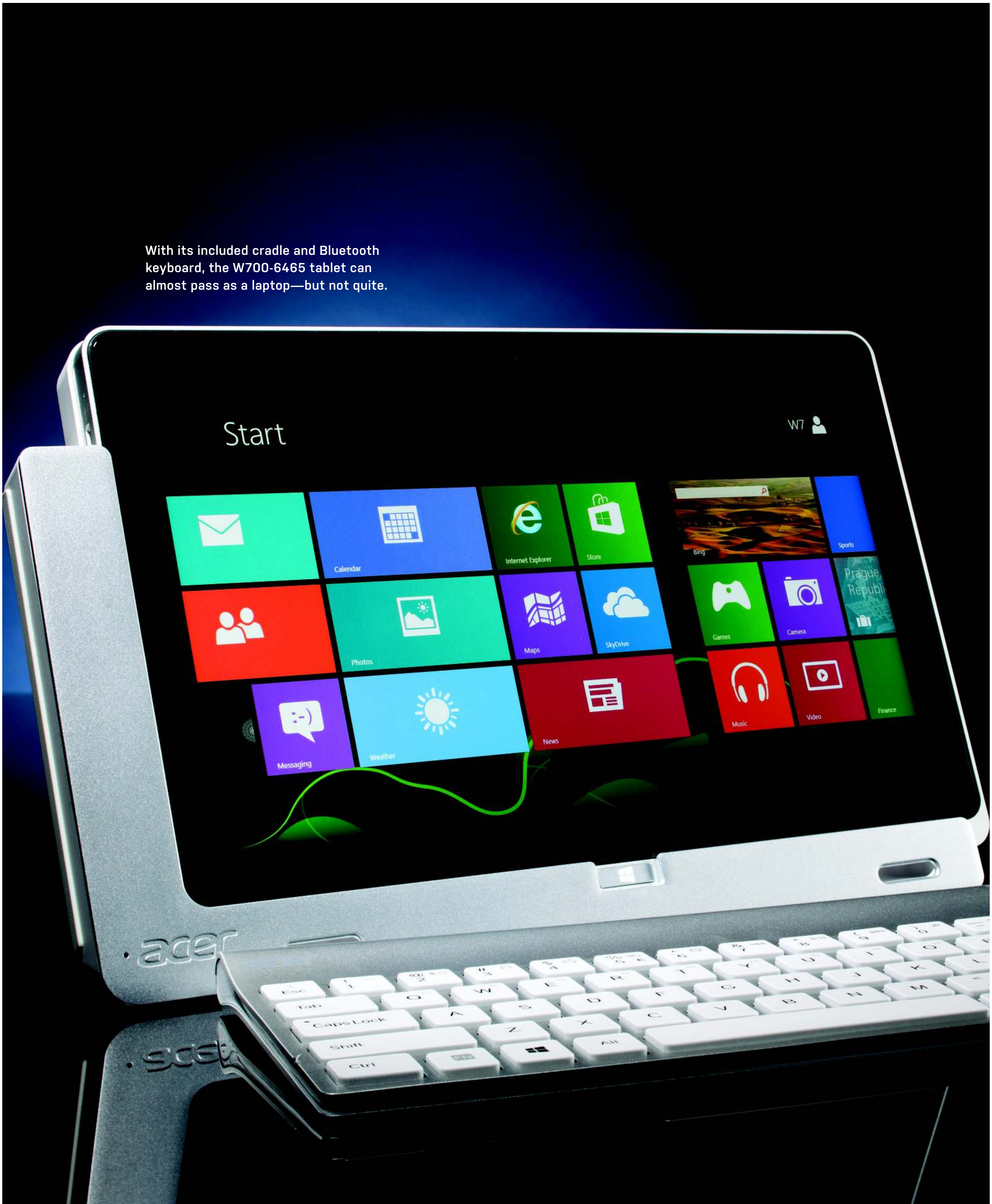
	ZERO-POINT	
Stitch.Efx 2.0 (sec)	1,092	1,057
ProShow Producer 5 (sec)	1,786	1,705
x264 HD 5.0 (fps)	12	12.4
STALKER: CoP (fps)	32.8	37.1
3DMark 11 Perf	2,979	3,719
Battery Life (min)	187	192

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point notebook is an MSI GT60 with a 2.3GHz Intel Core i7-3610QM, 12GB DDR3/1600, two 500GB Seagate 7,200rpm hard drives, a GeForce GTX 670M, and Windows 7 Home Premium 64-bit. STALKER: CoP tested at 1920x1080 with Ultra settings, Tessellation, and contact hardening.

SPECIFICATIONS

CPU	2.4GHz Intel Core i7-3630QM
RAM	16GB DDR3/1600
Chipset	Intel HM77
GPU	Nvidia GeForce GTX 675MX 4GB GDDR5
Display	17.3-inch, 1920x1080 LED display (matte)
Storage	64GB SSD, 750GB HDD
Optical Drive	8x DVD burner
Connectivity	Ethernet, VGA, HDMI, eSATA, all-in-one card reader, 3x USB 3.0, 2x USB 2.0, audio in, audio out, headphone, mic, 1.3MP webcam, Bluetooth, 802.11n
Lap / Carry	8 lbs, 9.3 oz / 10 lbs, 12.4 oz



With its included cradle and Bluetooth keyboard, the W700-6465 tablet can almost pass as a laptop—but not quite.

Acer Iconia W700-6465

It's a laptop. No, it's a tablet...

WHEN IT COMES to tablets, we'd wager that most *Maximum PC* readers lean toward the x86 variety—in theory, at least. Right? It's the more capable, more flexible option—the natural fit for computer nerds. In fact, with specs that rival an Ultrabook's, an x86 tablet promises to serve as the ultimate production/consumption device, leveraging Windows 8's dual persona to optimum effect. We haven't had face-time with Microsoft's x86-based Surface Pro standard-bearer—ironically, the company seems uninterested in getting its product in front of *these* power users—but we do have the Acer W700, an extreme tablet in its own right and a worthy representative of what this new tablet category has to offer.

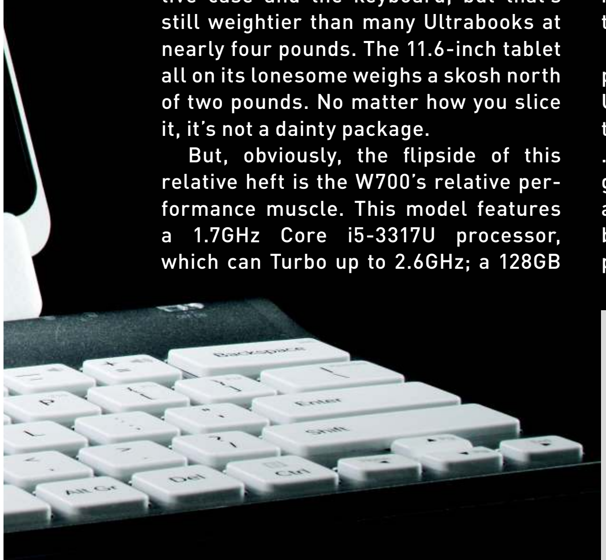
Acer sent us its W700-6465, a high-end model that comes with a cradle, a Bluetooth keyboard, and a faux-leather carrying case. The full assortment weighs a whopping six pounds, 6.25 ounces. You could minimize the load and carry just the tablet with its protective case and the keyboard, but that's still weightier than many Ultrabooks at nearly four pounds. The 11.6-inch tablet all on its lonesome weighs a skosh north of two pounds. No matter how you slice it, it's not a dainty package.

But, obviously, the flipside of this relative heft is the W700's relative performance muscle. This model features a 1.7GHz Core i5-3317U processor, which can Turbo up to 2.6GHz; a 128GB SSD; 4GB of RAM; and the full version of Windows 8. You can literally run any program on this tablet that you can on a laptop—rightly so, since this device costs $1,000. And while the W700 lagged behind our Intel reference Ultrabook in all the benchmarks, save battery life, it still performed in the neighborhood of every Ultrabook we've tested in the last six months.

We're much more put off by the *impracticality* of this tablet for desktop chores. The 11.6-inch IPS screen sports nice color, sufficient brightness, and wide viewing angles, but its 1920x1080 resolution makes everything on the desktop really small. Small enough that selecting items via touch will having you spewing more rage than Gordon Mah Ung. Why not use the Bluetooth keyboard's integrated trackpad? It doesn't bloody have one! (A capacitive stylus pen, for more precise action, can be purchased as an accessory for an additional $20.) We were also annoyed that the protective cover we received didn't house the keyboard—you'd have to tote that separately—but Acer tells us that new covers do.

In tablet mode, the W700 works as expected. Navigating through the Modern UI is smooth and responsive, and content looks nice on the HD IPS screen. The .5-inch, 2.1 pound aluminum body feels good in the hands, albeit slightly heavy, and the device gets warm during use, but never uncomfortably so. We were pleasantly surprised by the W700's battery life. Five hours of HD movie playback before conking out might fall short of an ARM tablet's battery life, but it's a good deal longer-lasting than a similarly spec'd Ultrabook.

In the final tally, though, we're not convinced that this is the ultimate dual-purpose device. Instead it seems like it's trying to be too much, and falling short in both of its purposes in the process. **–KATHERINE STEVENSON**



VERDICT 7

Acer Iconia W700-6465

+ REESE'S PEANUT BUTTER CUP Most powerful tablet we've tested; nice IPS screen; sturdy build.

– CUP-O-GOLD High-res screen problematic for desktop use; no trackpad on the keyboard; heavy for a tablet.

$1,000, www.acer.com

SPECIFICATIONS

CPU	1.7GHz Core i5-3317U
RAM	4GB DDR3/1333 dual-channel
Display	11.6-inch 1920x1080 IPS LCD
Storage	Toshiba 128GB SSD
Connectivity	On tablet: USB 3.0, Micro-HDMI, headphone/mic, power. On cradle: 3x USB 3.0, power
Lap / Carry	2 lbs, 1.1 oz / 6 lbs, 6.25 oz (w/ cradle); 3 lbs, 15.6 oz (w/o)

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS3 (sec)	840	1,080 (-22.2%)
Photoshop CS3 (sec)	100	116.3 (-14%)
ProShow Producer (sec)	1,122	1,432 (-21.6%)
MainConcept (sec)	1,901	2,385 (-20.3%)
Quake III (fps)	358.2	281.7 (-21.4%)
Quake 4 (fps)	76.1	65.5 (-13.9%)
Battery Life (min)	221	302

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point ultraportable is an Intel reference Ultrabook with a 1.8GHz Intel Core i5-3427U, 4GB of DDR3/1600 RAM, integrated graphics, a 240GB SSD, and Windows 8 64-bit.



The OCZ Vector is so close to the Samsung 840 Pro that in the real world it's mostly a tie.

512GB SSD Title Fight

The ultimate battle for solid-state supremacy

The Samsung 840 Pro was our top SSD until the OCZ Vector came along several months later and was able to run neck-and-neck with the Sammy through our benchmark gauntlet. As it currently stands, the 256GB versions of these drives both wear a 9/Kick Ass bandolier around their midsections, but there's still another contest that has yet to be decided. So this month, we gathered the 512GB versions of both drives and set them loose in the blood-splattered arena known as the Lab. –JOSH NOREM

OCZ VECTOR 512GB

The OCZ Vector surprised all of us with its speed and consistency when we first tested it in November of last year. Though it didn't *quite* eclipse the overall performance of the Samsung 840 Pro, it was an extremely close fight, which was a significant achievement for OCZ given Samsung's prodigious size and resources and OCZ's comparatively tiny stature.

Unlike OCZ's Vertex 4 drive, which used the Indilinx Everest 2 controller with Marvell silicon and OCZ and Indilinx firmware, the Vector uses a new controller named Barefoot 3 that is 100 percent OCZ's creation, both in terms of silicon and firmware. Controller aside, the Vector uses the same zippy 25nm IMTF MLC NAND found in the Vertex 4 but with all-new firmware. The 512GB Vector sports a slice-of-turkey-thin 7mm metal chassis with a pretty blue and black motif, and like all modern SSDs it rides the SATA 6Gb/s interface. The complete package includes an OCZ sticker, a 3.5-inch bay adapter, and a lengthy 5-year warranty. OCZ also makes its OCZ Toolbox software available for download; we'll cover that a bit more down below.

During testing, the 512GB Vector delivered the same scintillating performance we saw from the 256GB version, again allowing it to run nose-to-nose with the Samsung 840 Pro all the way around our test track. Though it took top honors in two of our nine tests, it was beaten by the Samsung 840 Pro in the other seven, making the Samsung drive the overall winner in what was a very close contest. In our sequential speed tests, both drives were pushing right around 500MB/s in both directions, which is running right up to the edge of the SATA 6Gb/s interface, so you'd be hard-pressed to find anything faster using current technology. In our 4K random-write test with a 32-command queue, both drives topped 80,000 IOPS but the Vector came up a bit short compared to the 840 Pro, yet tied with the 480GB Corsair Neutron GTX. In our new Sony Vegas test, the SSDs are told to write a humongous 200GB AVI file, so it's a test of straight-line speed, and in this test the Vector placed respectably but was again outpaced by the 840 Pro by a very close 18 seconds.

Overall, it was a great showing by the Vector but it clearly has as small speed disadvantage. The other area that's lacking is its OCZ Toolbox software, which covers the basics like secure erase and firmware updates, but is *ugly* and lacks many of the features of Samsung's software, making it one more area where OCZ needs to catch up. The Vector is still a fantastic SSD, but as a comprehensive package it's not quite able to overcome the 840 Pro's speed, software, and slight price advantage.

VERDICT 9

OCZ Vector 512GB

$540 (street), www.ocztechnology.com



Samsung's 840 Pro is about as fast as we can expect an SSD to be, given current technology.

SAMSUNG 840 PRO 512GB

When the all-new Samsung 840 Pro debuted a few months back, we were excited to see if Samsung could maintain its mojo—after all, the 830 Series was at the time our Best of the Best in the SSD category. We need not have worried about mojo depletion, as the 840 Pro was not just faster than the 830 Series drives, it was faster than any other SSD we had tested at that time, and in its maiden voyage in the Lab it broke seven out of nine benchmark records. This month, the 512GB version has arrived to preserve the brand's honor. We even heard it whisper to the Vector, "Prepare to die" when the two drives met on the test bench.

Like its 256GB stable mate, the 512GB Sammy Pro (476GB formatted) sports 21nm Toshiba MLC Toggle NAND instead of the less-expensive TLC NAND found in the non-Pro version of the drive. The drive comes with a 5-year warranty but does not ship with a 3.5-inch bay adapter, as it's clearly being marketed toward mobile users looking for a speed bump rather than desktop power-junkies like us. The Pro includes Samsung's Magician software, data migration software, and an aesthetic that matches the non-Pro series, which we think is a shame.

During testing, the 840 Pro demonstrated why it's on our Best of the Best list with a commanding performance. Even though it had the Vector and the Corsair Neutron GTX 480GB breathing down its SATA connector the whole time, it was still able to outpace both of them comfortably in the majority of our tests. Most interesting is the fact that the 840 Pro was able to beat the other drives in both sequential *and* random-write tests, which is impressive. Its most notable win was in Iometer, where the drive hit almost 90K IOPS, which is ridiculously fast. The only test where the 840 Pro lost to the Vector was in 4K incompressible write requests via AS SSD, which is even more of a torture test than Iometer, but the Samsung's score of 16,984 IOPS is still second-fastest for its class.

Finally, there's the SSD Magician software that comes with the drive, which is head-and-shoulders better than any other SSD software on the market. It shows you more information than you'd ever hope to find, like how much data has been written to the drive, AHCI status, and more.

The Samsung 840 Pro has the hardware chops to win our hearts, and its excellent software pushes it even further ahead of its competitors.

VERDICT **9** KICK ASS!

Samsung 840 Pro 512GB

$520 (street), www.samsung.com

BENCHMARKS

	OCZ Vector	Samsung 840 Pro	Corsair Neutron GTX	Samsung 840
Controller	Barefoot 3	Samsung MDX	LAMD	LAMD
Capacity	512GB	512GB	480GB	500GB
CrystalDiskMark				
Avg. Sustained Read (MB/s)	502	**534**	441	464
Avg. Sustained Write (MB/s)	499	**514**	478	333
AS SSD				
4KB Read (IOPS)	7,129	**8,064**	6,762	6,921
4KB Write (IOPS)	**18,506**	16,984	16,475	15,955
ATTO				
64KB File Read (MB/s)	511	**524**	345	335
64KB File Write (MB/s)	480	497	478	**531**
Iometer				
4KB Random Write 32QD (IOPS)	83,531	**89,297**	85,375	70,654
PCMark Vantage x64	**75,863**	75,205	67,426	52,557
Sony Vegas Pro 9 Write (sec)	314	294	**286**	327

Best scores are bolded. All tests were run on an Intel Core i5 3470 test bench with 8GB of RAM, an Intel 520 Series SSD, Gigabyte Z77X-UP4 motherboard, and a Cooler Master 450W PSU.



Belkin's WeMo is an inexpensive entrée to home automation, but its capabilities are somewhat limited.



iOS and Android 4.0 are currently the only smartphone options.

WeMo Switch + Motion

Home automation made simple—and cheap

THERE WAS A time when home automation was a toy only for the wealthy (for whom it worked because they could afford the incredibly expensive hardware) or the extremely geeky (for whom it *sometimes* worked because the hardware they could afford was reasonably priced but buggy—we're talking about you, X10). Belkin hopes to change that with its WeMo line.

Instead of relying on a central controller and an independent wireless network, as more elaborate systems do, WeMo devices operate on your Wi-Fi network and you control them using an iOS or Android 4.0 smartphone or tablet (the Android software was in early beta as of this review, so we used an iPod Touch for our evaluation).

The WeMo line isn't elaborate: It consists of a switch to control lamps and small appliances, a motion detector, and a baby monitor. The motion detector and the switch, reviewed here, work together. The WeMo Baby, which we didn't check out, monitors sounds in your baby's room and relays them to your mobile device.

The WeMo switch is a bulky plugin module with ground: Insert it into an electrical socket and then connect the device you want to control—a lamp or a small appliance, for instance—to the module. Install the WeMo software on your mobile device and you can turn the switch on and off and create simple rules to do the same. Add the WeMo Motion to the mix and it can turn the switch on and off when it detects movement (rules can apply here, too).

The rules are extremely basic: Turn the switch on and off at given times on given days of the week. The motion sensor can activate the switch in response to movement, to turn on the lamp in your foyer when you open your front door, for example. You can create a rule to ensure that this happens only when it's dark.

WeMo gets more fun when you link it into your IFTTT (If This Then That) account. Now, you can create more rules based on WeMo events: If the motion sensor is triggered, send me a text message, for instance. Unfortunately, IFTTT currently supports only one WeMo device per channel, so if you use the motion sensor to trigger an SMS, you can't use the switch to do the same thing (but you could have the switch send you an email).

The WeMo is certainly not the most sophisticated home-automation system we've tried, but it's relatively inexpensive and it's free from subscription fees. It's also early in its life cycle and Belkin seems committed to expanding its capabilities. –**MICHAEL BROWN**

VERDICT 8

Belkin WeMo Switch + Motion

+ LIGHTS ON Inexpensive; very easy to set up and manage; fun.

– NOBODY HOME Unsophisticated; bulky plugin modules; limited to controlling lamps and small appliances.

$100, www.belkin.com

A few parts on the case—like the holes for water-cooling tubes—require you to punch them out in order to use them.





Silverstone RL04

A budget case that's more incomplete than fun

BUDGET IS AS budget does, but Silverstone's RL04 just feels incomplete—or ill-designed—across a number of key areas. We suppose this case is worth looking into if you're tired of running all your parts and pieces on an open-air design—as in, propped up on cardboard boxes or Styrofoam. Otherwise, it's worth your while to explore some of the other cases in the sub-$80 category; the RL04 just isn't all that compelling.

For starters, imagine our delight to find that our review case shipped with one of the side panel screws missing. Sure, one screw holds a door on, but two screws would give us double the confidence that the RL04's extruded, grilled side-panel was properly attached to the rest of this mid-tower chassis.

The case's four 5.25-inch drive bays don't require you to pop off any kind of front panel in order to install new devices, just the smaller bay covers. We like that. We don't like the unpleasant, screwless connectors that keep one's devices locked into place, however. They feel a bit flimsy and we're not crazy about the turn-and-remove locking mechanism itself.

Five drive bays use handier trays to keep your 3.5- or 2.5-inch drives in place. You still have to use screws to attach said drives to said trays and, slightly more annoying, you install the drives from the case's right side, not the more conventional left. While you'd likely have to pop both panels anyway just to address the cable management, we still prefer to install or manipulate all of a case's guts from one side of the chassis.

Continuing its pattern of omissions, Silverstone neglected to preinstall any screws for the case's PCI expansion slots. It's not a deal-breaker, given that the slot covers will stay in place without them, but, again, a bit of an annoyance—you're hosed if you happen to misplace your little baggie of case screws.

Silverstone includes a two-fan-wide filter to install on either the case's top or side (it attaches magnetically). However, no matter where you stick it, the rectangular design of the filter doesn't perfectly line up with the case's angular accents—in other words, it looks bad.

The case itself comes with a single fan: a red, 12cm fan stashed in the case's front. There's no way to turn the fan's light on or off, but that's kind of a moot point since you don't get much of a glowing effect through the case's front-panel design.

The motherboard tray comes with a number of holes of various sizes for routing cables, and a huge area behind the CPU cooler itself is cut away—if you're looking for an easy aftermarket CPU-cooler upgrade, this one's a godsend. However, the case's angled design leaves little room for running cables on the extreme top and bottom of the chassis. This mainly affects the cable for the 4/8-pin ATX12V power connector; it's a tight squeeze, depending on the size of the cable your power supply is sporting.

Silverstone slaps the case's two USB 3.0 connectors on the front of its left side, a slightly odd place to store them. Your system's small reset button is located above that; the case's power button is actually Silverstone's giant snowflake logo—hrmph.

In general, we're a bit let down by the inner-workings (and deficits) of Silverstone's RL04. Even for a budget chassis, we find it a less satisfying product than, say, a similarly inexpensive case such as Fractal Design's Core 3000. Steer clear. **–DAVID MURPHY**

VERDICT 5

Silverstone RL04

+ VINCENT VEGA Decent cable management opportunities; USB 3.0 support; screwless (albeit annoying) 5.25-inch bay locking mechanisms.

– BUTCH COOLIDGE Only one fan; not all that screwless; cable management not easy; ill-fitting magnetic fan filter; reverse-installed drive bays.

$55, www.silverstonetek.com



He may not be pretty, but he's beautifully rendered.

Crysis 3

Third time is not quite the charm

PC GAMING IS where you go for high-octane visuals, and the original Crysis was no exception when it dropped in 2007. The highly anticipated sequel in 2011, however, proved a less ambitious affair. We traded a vast, free-roam jungle for the relatively restricted avenues of a war-torn New York City. There was usually more than one route to take, but this more linear experience arrived with some seams showing: Its advanced graphical options were inaccessible, the AI did not impress, and it did not even use DirectX 11 (at first). Crysis 3 fares better in some ways, but not in others.

The game's artificial intelligence is the most frequent and obvious offender. AI opponents are simply not very aggressive, even on the highest difficulties, and their tactics are reliably countered by just activating your stealth cloak and sprinting a short distance away. And you can now upgrade your abilities to make yourself even stealthier, faster, and deadlier. Ammunition is also plentiful, and your melee attacks are brutal even when the enemy sees you coming.

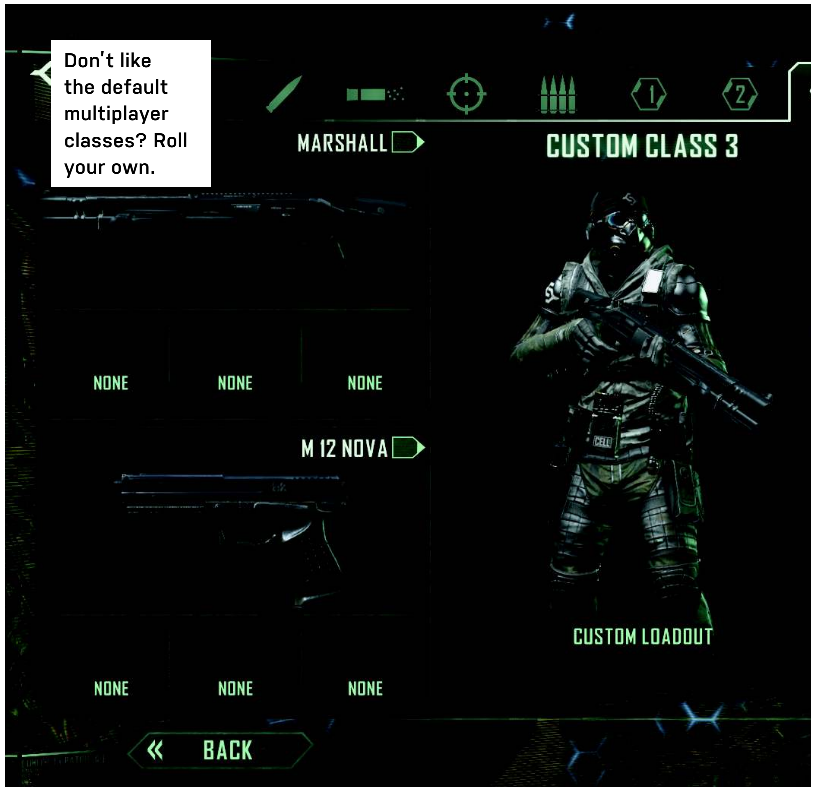
But while combat may be lacking, your arsenal certainly is not. The game provides a steady flow of new and interesting ways to kill people dead, from a heavy-duty composite bow with optional explosive-tipped arrows, to experimental assault rifles and things that don't even look man-portable. Crysis 3 is like a gun-nut toy store. You won't grab Assault Rifle #4216 and just stick with it the whole way. That said, some weapons are not as helpful, such as the shotguns; you'll rarely get close enough for them to be effective. And if you do get that close, a quiet bare-hands execution is usually more efficient and safer.

And let's not forget what Crytek consistently gets right: looking pretty. Out of the box, Crysis 3 has the full retinue of tweakable features, from ambient occlusion to texture quality to three different types of antialiasing. And it has DX11 on day one. The end result is a highly customizable experience. Or you can use one of four presets. The visual difference between "High" and "Very High" (presets three and four, respectively) isn't dramatic to the untrained eye, so you shouldn't feel obligated to build a new box with a $500 video card just to play this game. "High" gave us about 30–40fps on a GeForce GTX 660 (314.07 drivers) and a stock-clocked Phenom II 1090T at 1080p. The GTX 660 is about $200, but if you want a higher frame rate or to play at higher resolutions, you'll need more graphics oomph.

But it's not just graphical features on display. Crysis 3 is a genuinely beautiful game, especially in the faces of the characters you encounter. They are about on par with those of Far Cry 3, but with better lip-syncing and facial animation. Crysis 3



Your suit's stealth cloak lets you get up close and personal.



Don't like the default multiplayer classes? Roll your own.

ends up providing some eerily convincing digital "acting." The dialog isn't the best we've ever heard in a video game, but the delivery and body language are consistently well-done. The length of several of these in-game cutscenes may leave you restless, but you can skip ahead through most of them.

The scenery of a semi-reforested, rusted, and decaying New York City also has a kind of beauty, with trees growing in the middle of the street, high walls overgrown with ivy, and grass sprouting everywhere (though the grass's constant movement can get distracting at times). Rays of light shine through tree branches, and forest creatures such as squirrels and deer scamper around. There's really no city at all, at this point. Just the remains of civilization.

The lack of humanity left to rescue does undermine the story at times. Without giving too much away, suffice it to say that Crysis 3 ups the ante on save-the-world heroism, compared to the earlier games in the series and even sci-fi shooters in general. It would be nice to play one of these things without the story turning you into the only guy who can and must save everything. Are relatable motivations and perspectives really so bad? Never mind that sometimes you just want to forget all that, blow up some stuff, and have a few laughs.

Multiplayer offers a now-familiar model of experience point–based unlocks. You'll usually collect trickles of XP just from shooting other players, but there's also an achievement system that will deliver large chunks of it at once. You can also unlock abilities as well as equipment, deepening your specialization as a sniper, scout, heavy, or stealthy guy. Lastly, you periodically get a set of challenges to choose from, like "Get 10 kills with this weapon in one round," that reward a chunk of experience points. There's no failure condition, either—you can attempt it as many times as you like.

Multiplayer gameplay is definitely different because of your ability to stealth, but opponents are not impossible to detect at medium distance. Your cloak has a faint neon wireframe that distinguishes you from the environment. Enemies are even color-coded red for easier targeting, while your teammates are blue. We played on a number of public, third-party servers and rarely experienced lag or even slow load times.

The size of the multiplayer population is not heartening, however. On a random Thursday afternoon several days after release, the game reported about a couple thousand players online. Hundreds of servers, but most of them empty or under-populated. Granted, this is not deal-breaking (Natural Selection 2, for example, hovers around 2,000 active players), but it's definitely less than you'd expect from such a high-profile game. This kind of uncertain future can create a negative feedback loop, where people don't play because other people aren't playing.

Crysis 3's visual effects, voice acting, music, and animation are all about as good as it gets. But perhaps these more complex environments are simply too difficult for the AI to navigate and turn to its advantage; the single-player campaign rarely engages you or puts your suit abilities to the test. Multiplayer has a satisfying feel, but there isn't a killer feature or game mode to distinguish it from the dominant franchises. –TOM MCNAMARA

VERDICT 8 **Crysis 3**

+ TURKEY SHOOT Top-notch production values; interesting weapon variety; meaty multiplayer.

− RUSSIAN ROULETTE Single-player campaign is unchallenging; multiplayer community is small.

$60, www.mycrysis.com, ESRB: M



We'll add rappelling down the side of a frozen cliff to the list of non-undead-killing things we didn't expect.

Dead Space 3

The half-eviscerated zombie of first-person shooters

PERHAPS IF POOR ISAAC Clarke had been able to switch parts with the late Isaac Hayes, Dead Space 3 might have been a bit less boring. At this point, we'd gladly throw in a few Chef-like wisecracks just to liven up the game a tad—might as well rename this one "Dull Space 3."

We're exaggerating a little bit, but not much. The main problem with this third incarnation in the popular, "What the heck is that? Shoot it, shoot it, shoot it!" series is that the game lacks gravitas. And if you'll allow this review to get personal for a moment, it's just not all that scary—and that's saying something, as we generally hate those pop-out "gotcha" moments in movies, games, and zombie-inspired television shows.

Perhaps Dead Space has progressed beyond its horror-genre roots; or perhaps developer Visceral Games just hasn't done enough to shock and awe gamers beyond what's now become the Dead Space formula. If you've been sleeping with the lights on since the original Dead Space's 2008 release, let's play a quick game of catch-up.

Dead Space stars you, the poor (former) systems engineer Isaac Clarke, who just can't get a break from dealing with the aftereffects of humanity's greed. That comes mainly in the form of humankind's obsession with devices called Markers—otherworldly gadgets that provide limitless resources and energy with the not-so-subtle side effect of reanimating corpses in all sorts of grotesque and violent ways.

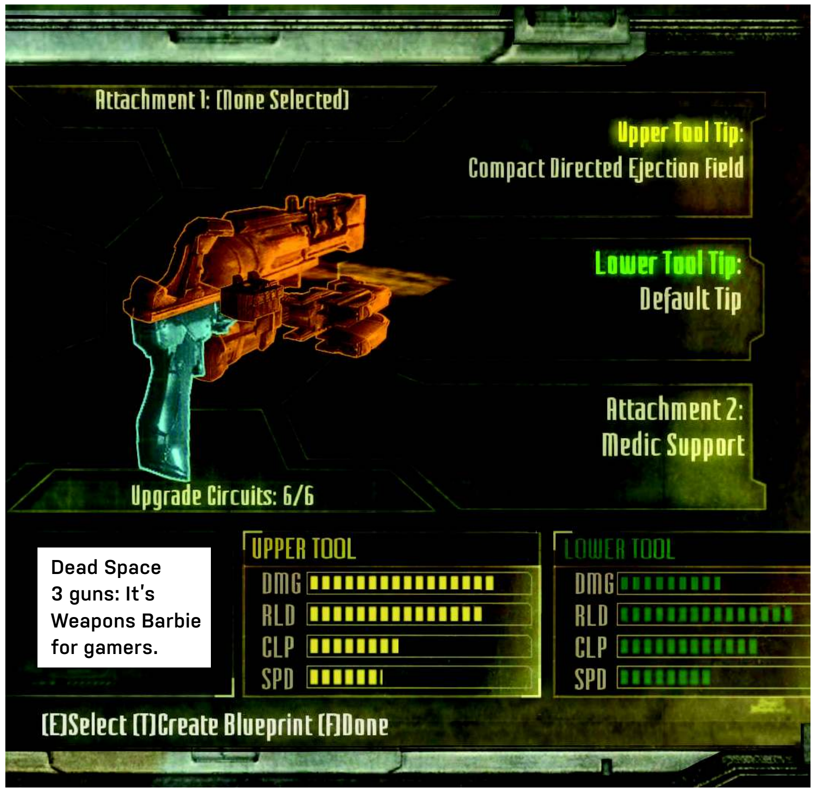
You, the star of the show and Marker-creator-and-destroyer extraordinaire, get conscripted into a (arguably) suicidal mission to find your researcher ex-girlfriend and then Indiana Jones your way to some *deus ex machina* device that can conceivably turn off every Marker forevermore.

The fundamental issue that bugs us about Dead Space 3 is that we can't quite tell if it's supposed to be a scary game or an action shooter—no, splitting the difference isn't allowed. We recall the original Dead Space being quite freaky and full of unpleasant, chilling moments, the kind of game that you don't really want to play with headphones on and lights off if you're the squeamish sort (think Doom 3 effect).

Although the baddies—mostly the Necromorphs—obviously come in a few new varieties in Dead Space 3, there's just nothing that really stands out to us as being particularly creepy about the game. Part of it is the fact that, by now, you kind of get what's going on in the series: Gross things will likely jump out at you and you'll already be primed to blow their limbs clean off. Only, not that much even really *jumps* out at you. Or rather, it's done in so expected a fashion as to render the entire scare factor relatively moot—like when one walks around a



You'll swear you were playing Star Wars: The Old Republic for a moment in one of the mini games.



Dead Space 3 guns: It's Weapons Barbie for gamers.

made-for-Halloween haunted house with a flashlight.

If anything, the scariest part of Dead Space 3 ties directly into its action elements, or lack thereof. Your primary enemy in the game isn't the undead, or the (silly) human factions that worship the undead and want to stop you. You'll be far more afraid of running low on ammunition than anything else Dead Space 3 has to offer if you're playing the game on anything beyond its normal difficulty. And if you're indeed going with the normal Dead Space 3 experience (and you've ever played a first-person shooter before), you'll find that the game's ample resource drops make it a bit of a walk in the park.

On hard difficulty (or worse), the game is more an exercise in resource management and precision shooting than a fun, undead-killing romp through space. It's the tried-and-true Dead Space formula of "insta-death boxing matches," game reloading, and a newfound joy of running for your life—a motif that's fun when it's done well, or done for the first time, but one that's starting to show its age at this point in the series. On normal difficulty, however, you might as well be a walking crucifix in a vampire retirement home—you'll emerge from your galactic adventures unscathed and unscared.

To Visceral's credit, Dead Space 3 is infused with a few fun elements that take it beyond your typical "stuck on a map; where's the end?" FPS questing. The game's occasional use of quick time events and so-so logic puzzles provide a wholesome reprieve from all the limb-scattering shooting. Although a good chunk of the game makes you feel like you're taking an exclusive tour of the set for the film *Event Horizon*, we especially enjoyed flying around in zero-gravity for a few missions. The game's effective use of transportation does a great job of tying expansive (and occasionally disparate) environments together—so much so, that we'll forgive Visceral for employing the Mass Effect–style "use elevators as cover for level load times" trick.

Dead Space 3's other big sell—weapon customization—provides a fun excuse for those looking to combine creativity with killing. The game takes a while to get resource generation up to speed, especially on the harder difficulties, but we do love the ability to change up our shooting style with a whole assortment of fun modifications. That said, the interface for the weapon modifications bench can be a little clunky, and it's tricky to tell just what it is your modification is ultimately going to do to your weapon—and just how badass a large suite of changes might be over others.

And, of course, there's the fear factor—namely, once Dead Space 3 allows you to concoct weapons with terrifyingly destructive capabilities, blowing limbs off baddies just isn't all that fearsome of a prospect anymore.

We didn't get a chance to check out the game's co-op mode, due to a lack of Dead Space 3 enthusiasm among our friends. But don't worry too much about that. Dead Space 3 is a good enough of a romp with plenty of content that it's worth spending a few days' worth of time blasting your way through all sorts of yucky monsters on the single-player side. Just wait for this one to hit the bargain bin (or Origin sale), lest you find yourself bored with some of the more uninspired parts of Necromorph-land. –**DAVID MURPHY**

VERDICT 7

Dead Space 3

+ LOVECRAFT NECRONOMICON Fun mini-game elements; comprehensive weapon customization; fun for walk-and-blast, undead-fighting gameplay; lovely in-game interface; lots to do.

− WARCRAFT NECROPOLIS Difficulty seems imbalanced; scarcity (or abundance) of resources can be frustrating; not all that scary anymore; so-so storyline.

$60, www.deadspace.com, ESRB: M

LAB NOTES

GORDON MAH UNG **DEPUTY EDITOR**



144Hz is Better, Right?

Give me benchmarks over subjective tests

AS THE WHITE lab coat for this month's Maximum PC Challenge (page 48), I tried to be as neutral as possible when asking people to choose which of the monitors they preferred. I soon realized that as much as I instructed people to simply pick the monitor that looked best to them, some of the test subjects wanted to pick the newer, "faster" technology. In fact, several were disappointed to learn they had chosen the 60Hz panel after the test was completed. To me, it didn't matter, I just wanted people to express their preference with no bias. But some of the test subjects seemed to think they had identified the 144Hz panel and appeared to shape their choices around that. In fact, I now wonder if my own personal preference for the 144Hz is actually unbiased. Do I favor 144Hz over 60Hz because it's newer or indeed because it's better? The tendency toward bias is one of the more difficult problems when a test is based on personal preference and not cold, hard benchmarks.





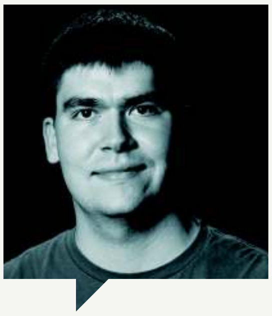
Josh Norem
Senior Editor

What a month for GPUs. First, the GTX Titan waltzed into the Lab and destroyed the single-GPU competition, and then the dual-GPU Asus Ares II walked in right behind the Titan, stole its lunch money, and took the dual-GPU crown from its big brother, the GTX 690. Next month: dual Ares II cards in CrossFireX (fingers crossed).



Jimmy Thang
Online Managing Editor

Microsoft got hit with a $731 million fine for not including other Internet browser choices in Win7 Service Pack 1. I'm no defender of big corporations, but I think the penalty is outrageous. Doesn't *everyone* know there are other options out there? It seems word-of-mouth alone would spur people to switch to Chrome or Firefox. Friends don't let friends use IE.



Chris Zele
Senior Intern

I recently reinstalled Windows 7 on my laptop and was frustrated by the barrage of updates that ensued. Even after I installed Service Pack 1, there were still dozens of other updates that I needed to download and install. I wish that Microsoft would give us another Win7 Service Pack to make updating fresh installs easier.



Tom McNamara
Associate Editor

With just a month under my belt, I've already built a rig, thrown a battery of benchmarks at tri-SLI Titans and a liquid-cooled HD 7990, participated in two podcasts, overclocked a CPU with a locked multiplier, reviewed a triple-A game, and defused a bomb placed by ninja leprechauns at the train depot. One of the above may have been a dream sequence, though.

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Cooling Benchmarks
> Far Cry 3 Review
> Eight vs. Six Cores

A Far Cry from an Honest Review

I just read your report on Far Cry 3 (March 2013) and I'm left wondering why you gave it a 9 verdict. You stated that this was a game that "starts out extremely strong, and slowly gets worse as you progress through it." If so, then why such a high rating? Correct me if I'm wrong here, but *Maximum PC* reviews should match their ratings, correct? I would expect at the very least that if *Maximum PC* reviews a game that in shorter terms is too lame to play, then it should reflect that in the rating. It only makes sense unless you guys are getting some sort of kickback for the way you rate games. And if you guys want to continue to give lame games high ratings just because a bomb blows up with pretty little sparklies but the story is dismal and weak, or you max out on guns, money, and abilities way before the game ends, then hand that pen over to me, fellas, and I will give it a review worthy of its rating! If you don't have the balls to do it, then I will!

—David Stephens

SENIOR TATAU WARRIOR JOSH NOREM RESPONDS: Thanks for the offer, David; it's appreciated. We gave it a 9 verdict because it is a seriously kick-ass game, and easily one of the best open-world games we have ever played, so we highly recommend it despite its shortcomings. In fact, throughout the first half of the game, while we were on the northern island, we were thinking it was our Game of the Year, as it was/is one of the best shooters we have ever played. For that portion, we were totally stoked on all the hunting, the crafting, the constant enemy attacks, and the slow building of our skill trees. It was glorious and epic, and we loved taking down enemy camps, doing the Path of the Hunter and Dead Man Walking quests, and the story wasn't too bad, either. But then the second half of the game happened and, well, yeah, it was a letdown, as we indicated. It's not bad enough to earn the game a 7, though, but bad enough that we not only removed our vote for Game of the Year, but also the Kick Ass award. We would have given it an 8 if the combat didn't totally melt our face off throughout the whole game. As for the kickbacks we got from Ubisoft, I just have to ask you David, "Did anyone ever tell you that you're insane?"

Tell Me Your Cool Ways

I'm a little confused about your cooler benchmarks. Your reviews show ambient air, idle temperature, burn temperature, and burn – ambient. The first three are self-explanatory but can you tell me: 1) What does burn – ambient mean? And 2) Where and how are the temperatures measured?

—Bob Pyle

ONLINE MANAGING EDITOR JIMMY THANG RESPONDS: Thanks for the cool question, Bob. "Burn – ambient" means burn temperature minus ambient temperature. The idea is to eliminate the fickle ambient temperature from the equation to find the cooler's "true cooling performance." It's not a perfect 1:1 exchange as 1-plus degree C in ambient temperature may not necessarily affect the CPU in the exact same capacity, but it gets you relatively close.

As for the where and how, we do all of our thermal testing in our Lab, which is kept in the low-to-mid-20 C temps. From there, we use CPU ID Hardware Monitor to take an average of our core temps and, voilà! That's how we keep our cool!

Encode Videos the Freemake Way

I don't know what the point of Neil Mohr's article was ("Encode Videos in Full HD Quality," March 2013), other than to take up space or show people how to step backward five levels in life. Just because "hackers" and scene traders encode files the hardest way possible using 15 different programs and tools doesn't make it correct nor higher-quality. Computers are here to make our lives easier for the most part. In this case, I would suggest you guys either stick with HandBrake as you have in the past, or my new favorite tool, Freemake video converter. Freemake is not only *free* as the name implies, but in many years of encoding video and re-encoding video for many different devices and the web, it's also the fastest frickin' tool I've ever used. It makes use of all procs as well as GPUs to give serious horsepower to convert even the largest MT2S files down to whatever video size, container, and codecs you want the final video to fit on. It flat out flies!

↘ submit your questions to: comments@maximumpc.com

The icing on the cake... excellent video quality and a synced audio stream that always matches if the source matches.

—Peter Richards

KATHERINE STEVENSON EDITOR-IN-CHIEF RESPONDS: Sorry you didn't like the story, but thanks for the recommendation, Peter. It's apropos given this month's Free Software cover story.

Native ISO-Burning in Win7

In your March 2013 issue you printed an article by Chris Zele on "An Affordable Linux Gaming Rig" (Build It). I was bemused when I came to Step 2 and read that "...Windows 7 doesn't natively allow burning ISO files like Windows 8 does."

Chris should have opened Windows Help and Support on a Windows 7 machine and typed "burn" to get instructions on how to "Burn a CD or DVD from an ISO file." The native utility Disc Burner does exactly that, and was what I used under Windows 7 Home Premium to create a bootable Ubuntu DVD after downloading the Ubuntu ISO.

—William Galway

SENIOR INTERN CHRIS ZELE RESPONDS: You're right that Windows 7 Home Premium does allow native burning of ISO files. Thanks for bringing this to my attention, and sorry for the misinformation.

I Was Afraid to Ask, but...

This is something I've always wanted to know but was afraid to ask. Back in the January 2013 issue, you guys built an all-AMD rig (Build It) and when talking about the CPU, Josh Norem said something that has always puzzled me: AMD's FX-8350, which is an eight-core CPU running at 4GHz, is apparently no match against the six-core Intel Core i7-3960X, which runs at 3.2GHz. I know that I speak for many when I ask, how come an AMD 4GHz FX-8350 with eight cores cannot even compete with an Intel Core i7-3960X 3.2GHz CPU with six cores?

—Oscar Rivera

DEPUTY EDITOR GORDON MAH UNG RESPONDS: There are several explanations. The first is that not all benchmarks can actually exploit all the cores on CPUs. But the real reason may lie in the Vishera's design. The eight cores are based on pairs of execution cores that share some resources. It's better than Hyper-Threading in theory, but not the same as eight stand-alone cores. You should also factor in that each CPU's micro-architecture is different in how it executes code, and one is simply more efficient than the other. The FX-8350 is actually more on par with Intel's Core i5-3570K in many of our benchmark tests. The basic lesson is that just as clock speeds don't matter (when trying to compare one CPU family to another) the same can be said of core counts. An eight-core ARM CPU at 2GHz, for example, would likely get trashed beyond recognition by a dual-core Phenom II or Core i3. ⏻

[NOW ONLINE]

LEAGUE OF LEGENDS—TEAM CURSE INTERVIEW

League of Legends is by far the most-played game right now. LoL is also as competitive as it is popular, and we had the chance to interview the top-ranked Team Curse. In the online Q&A, they talk about their insane practice regimen, share beginner tips, and more. http://bit.ly/Zd7SOC



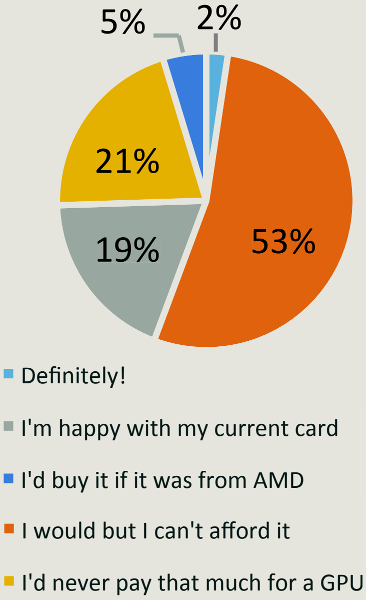
Facebook Polls

The One Piece of Free Software You Can't Live Without

In honor of this month's "Software Free for All" feature (page 24), we asked Facebook fans for their personal faves; here are some that didn't make our own list.

Crash Clinic Computer Repair: Hiren's Boot Disc
James Burt: Greenshot
Ryan Roberts: Mumble
Steven Rogers: Foobar2000
Kenneth Napier: Hitman Pro
Richard Ruben Ricca: TeamViewer
Mike Boyle: Ditto
Mitchell Eutsler: Ubuntu
Harrison Koch: LiberKey
David Creighton: WizMouse
Tyler Fulkerson: Wireshark
Jacob Brigance: Ninite
Jason Kupski: FileHog
James Kestel: PFSense
Horace Gregory: The command prompt

Will You Be Upgrading to an Nvidia GTX Titan?



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THE BUILDS

BASELINE



INGREDIENTS

PART			PRICE
Case	Corsair Carbide 200R		$55
PSU	Corsair HX650		$100
Mobo	Asus P8Z77-V		$175
CPU	Intel Core i5-3570K		$220
Cooler	Cooler Master Hyper 212 Evo		$31
GPU	MSI Radeon 7870 GHz Edition	NEW	$225
RAM	Crucial Ballistix DDR3/1600	NEW	$45
Optical Drive	Samsung SH-224BB	NEW	$16
SSD	Samsung 840 Pro 128GB	NEW	$130
Hard Drive	1TB Seagate Barracuda		$74
OS	Windows 7 Home Premium 64-bit		$90

Approximate Price: $1,161

THERE WERE a few changes to the Baseline this month, most of them lateral moves that saved us money. First, we switched to Crucial Ballistix RAM because the Patriot sticks we were using appear to have been discontinued, and we've always liked the Ballistix for budget-oriented systems. Second, the MSI Radeon 7870 GHz Edition replaces our EVGA GTX 660 because the two cards have the same price-performance ratio, but AMD's "Never Settle: Reloaded" bundle includes BioShock Infinite and the new Tomb Raider, and we can't pass that up. We also dropped the OCZ Vertex 4 for the Samsung 840 Pro SSD since the Sammy is faster and only costs an extra $8. We also swapped the optical drive, again, because this Samsung model is a few bucks cheaper than the Lite-On iHOS.

PERFORMANCE



INGREDIENTS

PART			PRICE
Case	NZXT Phantom 630		$180
PSU	Corsair HX750		$130
Mobo	Asus Sabertooth X79		$325
CPU	Intel Core i7-3820		$290
Cooler	NZXT Kraken X40		$85
GPU	Gigabyte Radeon HD 7970	NEW	$395
RAM	16GB Corsair Vengeance		$100
Optical Drive	Asus BW-12B1ST		$60
SSD	Corsair Neutron GTX 256GB		$200
Hard Drive	3TB Seagate Barracuda		$134
OS	Windows 7 Professional 64-bit		$140

Approximate Price: $2,039

THIS MONTH, we deployed parts of the Performance build in our Crysis box (see Build It, page 66), and it confirmed this config's kick-ass status. So, there are no major changes in the chipset/CPU department, and no changes in the SSD arena, either, since the Corsair Neutron GTX is almost as fast as the Samsung 840 Pro and the OCZ Vector, but it costs about $50 less—the perfect midrange SSD, in other words. In the GPU department, the XFX Radeon HD 7970 GHz Edition that we used last month has gone up in price by about $50, and we've had trouble finding them in stock, so it is gone-baby-gone. In its place is Gigabyte's "regular" edition, which costs $50 less, so it's a better value, and its clock speed is just 50MHz lower.

ULTRA



THIS MONTH'S ULTRA is arguably notable for what we *didn't* change. Despite the arrival of dual-GPU Radeon cards from PowerColor and Asus, and the single-GPU Titan from Nvidia, we're sticking with the GTX 690. Don't get us wrong, the PowerColor Devil 13 HD 7990 is a formidable performer, and the Asus's Ares II is even faster, but the Ares II costs *$500* more than the GTX 690 for just a 10–15 percent boost in performance, which is too rich for our blood. And besides, the air-cooled GTX 690 runs nearly as cool and quiet as the water-cooled Ares II. The GTX Titan? It's not even in the same league as these dual-GPU cards, so we'd never take it over a GTX 690.

The one thing we *did* switch this month was the SSD, going from the fat-and-fast Corsair Neutron GTX 480GB to a Samsung 840 Pro 512GB. The Samsung is both faster and has more capacity, and is just $25 more as of this writing, so it's a must-have for a box with the "Ultra" moniker.

INGREDIENTS

PART		PRICE
Case	Cooler Master Cosmos II	$325
PSU	Thermaltake Toughpower Grand 1050W	$200
Mobo	Asus P9X79 Deluxe	$375
CPU	Intel Core i7-3930K	$550
Cooler	Corsair H100	$100
GPU	Asus GTX 690	$1,000
RAM	16GB Corsair Vengeance	$100
Optical Drive	Asus BC-12B1ST BD-R Burner	$60
SSD	Samsung 840 Pro 512GB NEW	$475
Hard Drive	Seagate Barracuda 3TB	$135
OS	Windows 7 Professional 64-bit	$140

Approximate Price: $3,460

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best.

KICK ASS GEAR

Hardware we've deemed worthy of the highest honor



VIDEO CARD
Gigabyte GTX 660 OC
$230, www.gigabyte.com



SSD
OCZ Vector 256GB
$250, www.OCZ.com



MOUSE
Logitech G9x
$70, www.logitech.com



WATER-COOLING SYSTEM
Corsair H80i
$85 (street), www.corsair.com



GAMING HEADSET
Razer Tiamat 7.1
$180, www.razer.com

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